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For the convenience of Subscribers in remote places, the weekly numbers are reissued in Monthly Parts, stitched in a wrapper, and forwarded with the Magazines.—Subscriptions for the Stamped Edition for the Continent, for not less than 3 Months, and in advance, are received by M. BAUDRY, 9, Rue du Coq-St.-Honoré, Paris, or at the Athenæum Office, London. For France, and other Countries not requiring postage to be paid in London, 28 fr. or 1l. 2s. the year. To other countries, the postage in addition. [JAMES HOLMES, TOOK'S COURT.]

UNIVERSITY OF LONDON.
MATRICULATION.

NOTICE IS HEREBY GIVEN, that there will be no Examination on WEDNESDAY the 7th instant; but that the Examination fixed for that day will take place on THURSDAY the 8th, and that fixed for Thursday will take place on FRIDAY the 9th.
Somerset House, Oct. 1, 1840. By order of the Senate, R. W. ROTHMAN, Registrar.

CHEMISTRY.—Professor DANIELL will commence his Course of LECTURES upon the FORCES which concur to the production of Chemical Phenomena, on THURSDAY Afternoon next, the 8th instant, at Three o'clock, and it will be continued on every subsequent Friday, Monday, Tuesday, and Thursday, at the same hour.—A Prospectus and other particulars may be obtained upon application at the Secretary's Office. J. LONSDALE, Principal.
King's College, London, Oct. 1, 1840.

KING'S COLLEGE, LONDON.—DEPARTMENT of CIVIL ENGINEERING and ARCHITECTURE, and of SCIENCE applied to the Arts and Manufactures. —This Department, under the superintendence of Professors Hall, Moseley, Daniell, Wheatstone, Hosking, and Ansted, and Mr. Bradley, Mr. E. Cowper, Mr. J. Tennant, and Mr. H. J. Castle, will be RE-OPENED on TUESDAY next, the 6th inst.
A Junior Class, for Pupils of the age of 14 years or upwards, will also be opened on the same day.
Oct. 1840. J. LONSDALE, Principal.

KING'S COLLEGE, LONDON.—DEPARTMENT of GENERAL LITERATURE and SCIENCE.—The CLASSES in THEOLOGY, the CLASSICS, MATHEMATICS, ENGLISH LITERATURE, and HISTORY, under the Superintendence of the PRINCIPAL, and Professors the Rev. T. G. HALL, R. W. BROWNE, and F. MAURICE, will be RE-OPENED on TUESDAY next, the 6th instant.
The Classes for Private Instruction in Hebrew, the Oriental, and other Foreign Languages, will also be resumed.
N.B. Chambers are provided for such matriculated Students as are desirous of residing in the College; and some of the Professors, and other Gentlemen connected with the College, will receive Students into their houses.
1st Oct. 1840. J. LONSDALE, Principal.

UNIVERSITY COLLEGE, LONDON.—FACULTY OF ARTS AND LAWS.—Session 1840-41.
The Session will commence on Wednesday, the 14th October, when Professor Creasy will deliver a Lecture INTRODUCTORY to his own Courses, at Two o'clock precisely.

Classes.

LATIN..Professor Key, A.M.
GREEK..Professor Malden, A.M.
HEBREW..Professor Hurwitz.
ARABIC, PERSIAN, and HINDUSTANI..Prof. Falconer, A.M.
CHINESE LANGUAGE and LITERATURE..Professor Rev. Samuel Kidd.
ENGLISH LANGUAGE and LITERATURE..Prof. Latham, A.M.
FRENCH LANGUAGE and LITERATURE..Prof. Merlet.
ITALIAN LANGUAGE and LITERATURE..Prof. Pepoli.
GERMAN LANGUAGE..Teacher, Mr. Wittich.
MATHEMATICS..Professor De Morgan.
NATURAL PHILOSOPHY..Professor Sylvester, F.R.S.
CHEMISTRY (Practical Course, commencing in May)..Professor Graham, F.R.S.
CHEMISTRY (Course for the Matriculation Examination in Arts at the University of London)..Professor Graham.
BOTANY, Junior Class do. (commencing in April)..Professor Lindley, Ph. D.
ZOOLOGY..Professor Grant, M.D.
PHILOSOPHY OF MIND and LOGIC..Professor the Rev. J. Hoppus, Ph. D.
HISTORY, ANCIENT and MODERN..Professor Creasy, A.M.
ENGLISH LAW (commencing 4th Nov.)..Prof. Carey, A.M.
JURISPRUDENCE (commencing 3rd Nov.)..Prof. Graves, A.M.
CIVIL ENGINEERING..Professors De Morgan, Graham, and Sylvester.
DRAWING, in all its branches..Teacher, Mr. G. B. Moore.
SCHOOLMASTERS' COURSES..Professors Key, De Morgan, Sylvester, and Malden.

FLAHERTY SCHOLARSHIPS.

A Flaherty Scholarship of 50l. per annum, tenable for four years, will be awarded in 1841 to the best proficient in Classics among the Students of the College under the age of twenty years. The Examination will take place in the second week in October. A similar Scholarship for proficiency in Mathematics and Natural Philosophy will be awarded in 1842, and in subsequent years, alternately, for proficiency in Classics, and in Mathematics and Natural Philosophy. Printed copies of the Regulations concerning these Scholarships may be had on application at the Office.
The Session of the Faculty of Medicine commences on 1st October.
14th August, 1840.
T. HEWITT KEY, Dean of the Faculty.
CHAS. C. ATKINSON, Secretary to the Council.

SCHOOL of ANATOMY and MEDICINE, adjoining St. George's Hospital, 1840.—LECTURES will be given during the ensuing Season, commencing OCTOBER 1st, on—
ANATOMY, PHYSIOLOGY, and SURGICAL ANATOMY..by Mr. Lane.
PRACTICAL ANATOMY, with Demonstrations..by Mr. Meade and Mr. Ancram.
The PRINCIPLES and PRACTICE of MEDICINE..by Dr. Sigmond and Dr. Fitzherbert.
The PRINCIPLES and PRACTICE of SURGERY..by Mr. Lane and Mr. Chapman.
MIDWIFERY and the DISEASES of WOMEN and CHILDREN..by Mr. Bloxam.
MATERIA MEDICA and THERAPEUTICS..by Dr. Sigmond.
CHEMISTRY..by Mr. Balmain.
MEDICAL JURISPRUDENCE..by Mr. Hutchins and Mr. Ancell.
BOTANY during the Summer Session.
General Fee to the whole of the Courses Forty Guineas, half of which may be paid on the entrance of Pupils, and the remaining half at the commencement of the second division of the Course.
Further particulars may be obtained at the Theatre, 1, Grosvenor-place; or at the residences of the Lecturers.

PHYSIOLOGY.—Mr. SOLLY will COMMENCE his COURSE on PHYSIOLOGY and COMPARATIVE ANATOMY, at St. Thomas's Hospital, on MONDAY EVENING, the 5th instant, at quarter before 7 o'clock precisely.

SCHOOL of MEDICINE, PORTLAND-STREET, GLASGOW.—Dr. M. S. BUCHANAN, Senior Surgeon to the Royal Infirmary, Member of the Faculty of Physicians and Surgeons, &c., will COMMENCE his WINTER COURSE of DESCRIPTIVE and PHYSIOLOGICAL ANATOMY, on WEDNESDAY, 4th NOVEMBER, at 5 o'clock P.M. And also his COURSE of DEMONSTRATIVE and SURGICAL ANATOMY, on Thursday, 5th November, at 1 o'clock P.M.
Fee for each Course, 2l. 2s.; for both Courses, 3l. 3s.; Perpetual, 7l. 7s.
The Saloon for Practical Anatomy, which is spacious and well ventilated, will be open from 9 A.M. till 9 P.M., and private apartments have been provided for those gentlemen advanced in the profession, who may wish to avail themselves of the increased facilities now so amply afforded for the prosecution of Anatomy and Operative Surgery.
Fees for Dissection of every part of the Body, or for a Complete Series of Surgical Operations, including the use of Instruments, 2l. 5s. Separate parts of the Body in the same proportion.
Certificates of attendance on the above Courses of Anatomy, as well as those granted by the respective Lecturers on all the other branches of Medical Science taught at this School, are received by all the licensing boards in the Kingdom, and by those of the Army, Navy, and Hon. E. I. Company.
N.B. Students of Medicine ought well to remark the state of two most important branches of education at Glasgow, viz. 1st, Anatomy; and 2nd, Hospital Instruction.
The material for the first is far more abundant, and the price much lower in Glasgow, than any where else, with the exception of Paris.
The Royal Infirmary fee is 7l. 7s., which entitles Pupils to attendance during two years, and also includes two full Courses of Clinical Medicine and Surgery.
The number of patients daily in the wards is 450; the number yearly treated upwards of 5000; and the number of surgical operations average annually 130. Forty-eight Dressers are yearly appointed to the surgical wards, without any additional fee. The post-mortem inspections are regularly performed in presence of the Pupils; and there is a Dispensary, where upwards of 7000 diseased poor annually receive advice, to which also the Infirmary Students are admitted *gratis*.

MANCHESTER NEW COLLEGE, IN CONNEXION WITH THE UNIVERSITY OF LONDON.
Sir BENJAMIN HEYWOOD, Bart. President.
The COLLEGE will OPEN for the ADMISSION of STUDENTS on the 5th OCTOBER next, in Grosvenor-square, Chorlton-upon-Medlock. The Committee solicit the attention of the public to the Course of Instruction provided in the *Literary and Scientific Department*, viz.:—
I. Greek and Latin Languages; Lectures on the Grammatical Structure of the English Language, with Exercises in English Composition, F. W. NEWMAN, Esq. B.A., late Fellow of Balliol College, Oxford, and Classical Tutor in Bristol College.
II. Pure and Mixed Mathematics, R. FINLAY, Esq. B.A., Trinity College, Dublin.
III. Ancient and Modern History, and the History of Literature, Rev. JOHN KENRICK, M.A.
IV. Mental and Moral Philosophy, and Political Economy, Rev. J. MARTINEAU, of Liverpool.
V. Physical Science and Natural History, MONTAGUE L. PHILLIPS, Esq.
The entire Course will comprise three Sessions of nine months each, extending from the beginning of October to the end of June. The Classes of the first year will be occupied in preparing for Matriculation at the University of London; those of the second and third years, in preparing for the Degree of Bachelor of Arts. Students will be admissible into the College on the completion of their fifteenth year. Those who enter with a view to graduation will be required to undergo an examination in Classics and Mathematics previous to admission, and to submit to the prescribed exercises and examinations during the whole course; but the Classes will be open to other students, with whom submission to such exercises and examinations will be optional.—A detailed statement of the course of study, with a list of fees, is published, and may be obtained at the principal Booksellers in Manchester and Liverpool; or on application personally to the following Members of the Committee:—
Samuel Robinson, Esq. Dukinfield.
J. Aspinal Turner, Esq. Cross-street, Manchester.
Robert Worthington, Esq. No. 8, Princess-street, Manchester.
James Heywood, Esq. Acresfield, near Manchester.
Rev. W. Gaskell, Dover-street, Chorlton-upon-Medlock.
Samuel D. Darbishire, Esq. Marsden-street, Manchester.
Or by letter to the Secretaries, to the care of S. D. Darbishire, Esq.
Manchester, Sept. 15, 1840.

Sales by Auction.

MR. L. A. LEWIS will SELL BY AUCTION, at his House, 125, Fleet-street, on TUESDAY, October 6, and following day, A VALUABLE COLLECTION OF BOOKS, including a Selection from the LIBRARY of an ARCHITECT.
The following Sales are in preparation:—
The VALUABLE PRIVATE LIBRARY of a COUNTRY BOOKSELLER; together with a Portion of his general Stock.
A VALUABLE COLLECTION of BOOKS.
The THEOLOGICAL and MISCELLANEOUS LIBRARY of a CLERGYMAN.
A MISCELLANEOUS COLLECTION OF BOOKS.
The VALUABLE LIBRARY of a GENTLEMAN, Deceased, removed from the Country.
A VALUABLE COLLECTION of BOOKS on the FINE ARTS; ARCHITECTURAL BOOKS, &c.
An IMPORTATION from the CONTINENT.
A COLLECTION of ENGRAVINGS.

SALE of VALUABLE STEREOTYPE PLATES and COPYRIGHTS.—Mr. KEITH begs to intimate to the Trade, that he has been instructed to offer for public competition, in the Royal Exchange Sale Rooms, Glasgow, on MONDAY, the 5th day of October, at 12 o'clock noon, the STEREOTYPE PLATES and ENTIRE COPYRIGHTS of the following valuable and highly-popular Publications; viz. The Scottish Pulpit, 5 vols. 8vo.—The Scottish Worthies, with Mr. Gavin's Notes, 2 vols. 8vo.—The Glasgow Mechanics' Magazine, 5 vols. 8vo.—Drs. Dewar and M'Leod's Gaelic Dictionary—Johnson's Lives of the Poets, 2 vols. 12mo.—Macnish's Anatomy of Drunkenness; ditto Philosophy of Sleep; ditto Book of Aphorisms—Butler's Hand-book for Australian Emigrants—Boswell's Poultry Yard; ditto Treatise on Bees; ditto Art of Taxidermy—Blacklock's Treatise on Sheep—The Practical Farmer's Manual—Stewart's Advice to Purchasers of Horses—Small's Veterinary Tablet—Reid's Science of Botany; the Science of Geology—Mason on Self Knowledge, 18mo.—Wilberforce's View on Christianity—M'Gavin's Brief History of the Protestant Reformation—My First Concealment—United States of America at one View—Wilson's Wonderful Characters.
From the high character and extensive sale which the above works have obtained, the sale of them presents an opportunity seldom to be met with, as they are parted with solely in consequence of the proprietor turning his attention to another department of the trade. Orders from gentlemen who cannot attend the Sale, addressed to Mr. Keith, or Clerk of Sale, will meet with the strictest attention.

HIGH-PRESSURE STEAM-ENGINE for SALE, of costly workmanship, nearly equal to new, having been at work about 12 months. Price, including the two Boilers, 200 Guineas. May be seen at work at the Polytechnic Institution, Regent-street, where an Engine of peculiar construction is to be substituted.

RETREAT, near LEEDS, for the RECEPTION and RECOVERY of PERSONS afflicted with DISORDERS of the MIND.
Mr. HARE begs to announce to the Profession and the Public, that the above Establishment is under his particular superintendence, and that the most strict attention is paid to the medical, as well as moral treatment, of individuals committed to his care.
The Retreat is delightfully situated on rising ground, at the opening of Aire-Dale, little more than a mile from the town of Leeds. The situation is healthy, cheerful, and also sufficiently retired; the gardens and plantations are extensive; the premises combine proper accommodation for the exercise and amusement of the patients, and the apartments are spacious, lofty, well ventilated, and fitted up in the most commodious manner.
The Establishment is to be considered more in the light of a temporary residence in the country, where the patient is placed while he undergoes such a plan of treatment as may be necessary to restore the functions of the brain, than as an asylum, in the common acceptation of the term; hence it is well suited for persons of weak mind, or who may be subject to fits of temporary insanity—for whom confinement is necessary.* In recent cases a perfect and speedy recovery may generally be expected.
Applications, either personal or by letter, postage free, addressed 26, East Parade, Leeds, will meet with immediate attention, and have the most satisfactory references, if required, to patients already discharged, or their friends; also to physicians resident in London, Dublin, Leamington, Leeds, Sheffield, Scarborough, Wakefield, Bradford, &c., who have had occasion to visit patients at the Retreat.
* *Mr. H. also receives patients under his care, attended by experienced persons, in lodgings or private houses, according to the provisions of the 2nd and 3rd of Wm. IV. chap. 100, section 47.*

FUTURE AND EXISTING CHILDREN.

FAMILY ENDOWMENT SOCIETY LIFE ASSURANCE AND ANNUITY OFFICE, No. 12, Chatham-place, Blackfriars, London.—Capital, 500,000l.
George Alfred Muskett, Esq. M.P. *Chairman.*
W. Butterworth Bayley, Esq. *Deputy Chairman.*
A married man, paying a yearly premium, or a single sum, varying according to the age of his wife, would secure to each of his future Children, however numerous, a specific sum on attaining any given age.
Example:—Wife aged 21..8l. 18s. 6d. Annual Premium for 22 years, or 134l. 1s. 8d. paid in one sum, would entitle each Child attaining 21 years of age to 100l.
Life Assurance and Annuities effected on advantageous terms.

UNITED KINGDOM LIFE ASSURANCE COMPANY, 8, Waterloo-place, Pall Mall, London.
The first Septennial Division of Profits of this Company will be declared in the ensuing year on all Policies of the participating class effected previous to the 31st December, 1840. Parties, therefore, who wish to Insure their Lives, should avail themselves of the opportunity they now have of sharing in the bonus so soon to be declared by immediately making proposals.
The following are the Annual Premiums for the assurance of 100l. for the whole period of life, on which half credit may be allowed for five years; which credit may remain at five per cent. interest, to be deducted at death from the sum insured:—

Age.	Without Profits.	With Profits.
20	£1 13 10	£1 18 8 per Cent.
30	2 3 10	2 8 2
40	2 19 1	3 3 4
50	4 6 0	4 10 7

Annual Premium for assuring 100l. payable at a fixed age, or at death, should it occur before the party attains that age:—

Age to be attained.		Sixty.	Sixty-five.	Seventy.
Age when assured,	20	£2 6 1	£2 2 4	£2 0 0
	30	3 2 10	2 15 2	2 10 6
	40	4 19 0	4 0 3	3 9 7
	50	10 14 10	7 8 1	5 12 2

EXAMPLE.—A person aged 20, by paying an annual premium of 2l., becomes entitled to 100l. on his attaining the age of 70, or to the same sum should he die before arriving at that age.
For the convenience of parties residing in the City, they may make their appearance and pass the medical examination before the Agents, Edward Frederick Leeks, Esq., 4, Scots-yard, Bush-lane, Cannon-street, and S. F. Youde, Esq. Surgeon, 9, Old Jewry.
Every information will be afforded on application to the Resident Director, Edward Boyd, Esq., No. 8, Waterloo-place. Proposals may be accepted on Wednesday at 3 o'clock, and any other day appearance may be made at half-past 2 o'clock, when Frederick Hale Thomson, Esq., the Company's Surgeon, is in attendance. EDWARD LENNOX BOYD, Sec.

LONDON, SATURDAY, OCTOBER 3, 1840.

REVIEWS

A General View of Egypt. [*Aperçu Général, &c.*] By A. B. Clot-Bey. 2 vols. Paris, Fortini.

If we could believe that Clot-Bey were really the author of these volumes, we should unhesitatingly pronounce him the most expert of journeymen *littérateurs*—the most accomplished of book-makers. Known hitherto only as an able field surgeon, he seems at once to have become consummate master of the most subtle of the many curious arts which reach their perfection in Paris. Here we find the history of Egypt, ancient and modern; its natural history in every branch, including a list of its vegetable productions; we have a topographical description of the country; a dissertation on Mohammedanism, with abundant extracts from the Koran; and also numerous chapters on domestic manners; the management of the harem, marriage, &c.; chapters on the various nations who visit Egypt; chapters on every branch of industry, on every public work or institution, and on every kind of speculation. We have chapters in defence of the Pasha; and, finally, we have the Antiquities of Egypt despatched in twenty light pages. In fact, never before was so wide a field skimmed over with such unerring impartiality; no predilection or professional bias has induced the author in any instance to penetrate beyond the surface, or to dwell on any topic with the force and heartiness of an original observer. One might suspect that he had emptied on his papers, the Table of Contents of the Memoirs of the Institute of Egypt, and then, by ligature and compression, had forced the fragments to unite. If so, the operation was certainly most dexterously performed. But it is also possible,—and we are inclined to this opinion,—that Clot-Bey has lent his name to volumes manufactured by the common trade machinery. The work, we are told in the preface, has been printed in great haste, owing to the political conjuncture which seemed to call for it. Perhaps it might have been added, without departing from the truth, that it was also written in great haste, by many experienced writers, whose contributions were skilfully dovetailed together, and polished into uniformity; Clot-Bey, armed with the potent wand of the Bibliopolists, being the genius at whose bidding the sprites worked. It must be admitted that the work, thus prepared, has an elegance, a correctness, and an air of refinement which will entitle it to the favour of those who are disposed to be satisfied with what is eminently superficial. We, however, set little value on such slight sketches, and shall here allow ourselves to be enticed into a consideration only of such of our author's topics as relate to the present political situation of Egypt.

It was unnecessary for Clot-Bey to announce to the world in his preface, that his volumes were not written at the command of the Viceroy of Egypt, nor with a view to eulogize that prince. It is obvious that a justification of the Viceroy, written at his express desire, would have taken a less trivial form, a more serious tone, and would have appealed frequently to official documents. But, on the other hand, it cannot be supposed that the chief officer of the medical staff of Egypt, because he writes spontaneously, is therefore a perfectly impartial and unconstrained witness, or that he is not compelled by considerations of interest and by habits of devotion to the Viceroy, to advocate at any rate the views of the latter. Aided, as he avowedly is, moreover, by those who have taken an active part in the discussion of the Eastern question, it cannot be supposed that he is in ignorance of any of the arguments available for his cause. We feel justified, therefore, in regarding him as a well-instructed as well as sincere advocate, whose studiously dispassionate and unobtrusive pleading is more likely to gain confidence than any elaborate display of eloquence.

In this country there are, of course, many who regard Mohammed Aly with the admiration which usually follows those who have raised themselves from humble life to eminence. Success has given a sanction to his ambition, and constituted him what is popularly, though not always justly, called, a great man. We have no wish to deny him the possession of great qualities, or to divert from him a sympathy flowing from sentiments universally current, and which naturally belongs to him. But in France, the favour with which he is looked upon is not derived from his fame and fortune; it has its source in quite another train of feelings. The French invaded Egypt under the impulse of lust of conquest, and driven by the restless military spirit that followed the revolution. They never thought of justifying that proceeding by reference to any principle of public right or morality. They had an easy triumph over the Mamelukes and loose bands of undisciplined Arabs; and, strange to say, they imagined that the conquered people were affected with the same intoxication as themselves, and shared in their glory. But what followed? The French fleet was destroyed; Bonaparte withdrew rather ingloriously from Egypt; and, after a short struggle, the French army was obliged to capitulate: in short, the French were expelled from Egypt, a country to which they had no claim. Yet these reverses are all erased from their memories; they remember nothing but their conquests and their glory. In all that has been written in Paris on the Eastern question, even in the *brochures* of Academicians, we find it assumed that the French nation has, by right of victory, a vested interest in Egypt. Mohammed Aly, as Clot-Bey expresses it, "has gathered the heritage of France." How far these reversionary claims are reconcileable with the views of Mohammed Aly, we shall not, on the present occasion, turn aside to inquire. The French manifestly reckon on keeping him in tutelage: and it is also evident, that popular opinion in France, with respect to the Eastern question, is swayed in favour of the Viceroy, not through generous sympathy with him, but in consequence of an absurd, egotistical, and dangerous national vanity.

If we admit, with our author, that the French and Napoleon were the first civilizers of Egypt, then it is evident that the civilization of Egypt is of very recent date; and Clot-Bey's assertion that the reforms made in Turkey have been imitated from those of Egypt, is glaringly erroneous. The continuous efforts of the Ottoman Sultans to reform their empire, extend backward above a century; but to confine ourselves to the mention only of the measures in which the French took a part, it may be observed that the National Assembly sent a squadron of artillery to Constantinople, to serve as a model for the Sultan's new army. At that time, and for many years previously, there was a printing press in the palace of the French ambassador at Constantinople, actively employed in promoting the civilization of Turkey.

The French of that day piqued themselves on being the only sincere allies of the Turks; but now, without assigning any reason, they have withdrawn their attachment from Turkey, and have transferred it to Egypt, and to a rebellious vassal. Turkey, says Clot-Bey, never really possessed Egypt; and the Arabs were always hostile to the Osmanlis. But is not Mohammed Aly an Osmanli? Is not the objection made to him by those who view his conduct critically, merely this, that he governs like a clever Turk, who extorts revenue and increases his army without the least regard for the happiness and well-being of those under his sway? Our author defends the Viceroy's seizure of property and territorial exactions by the following brief argument:—

The experience which the French, during the expedition, had of the Fellahs (Egyptian peasants), and that acquired by all Europeans who have spent some time in Egypt, prove completely that the system of property now established by Mohammed Aly is, in itself, the best possible system.

Of this best possible system he soon after observes:—

I do not dissemble that there are many improvements to be made; but to those who impute as a crime to Mohammed Aly, the defects of the present state of things, I answer, first, that the present state of things is a great deal better than the past; and secondly, that it is only temporary, and promises a bright future to the Egyptian people, who, as they grow civilized, will be admitted to the property of the soil. I add, furthermore, that whatever there is oppressive in this state of things, must last so long as the political existence of Mohammed Aly and his dynasty shall not be solemnly established; and that ameliorations will infallibly take place whenever this question of life or death shall be determined; and that, in the meantime, it is highly unjust to make the Viceroy responsible for the consequences of a struggle undertaken and supported with a view to snatch from him the legitimate reward of his long and glorious efforts.

It is laughable to find, that the "best possible system" is not only thought to be susceptible of amelioration, but also to have the merit of being merely transient and preparatory to a still better; but it is more important to remark, that the advocates of the Viceroy habitually reason in a circle, for, without stopping to excuse the miscalculated oppressiveness of his government, they assume at once that he "merits the reward of glorious efforts." On the important Syrian question, our author says,—

The annexing of Syria to Egypt was necessary to the safety of the Viceroy's possessions. From the moment that it was deemed expedient to make the banks of the Nile the seat of an independent power, it ought to have been acknowledged that this end can only be attained by uniting Syria and Egypt. We have seen, that the military topography of this country does not guarantee it from foreign invasions, particularly by the isthmus of Suez. With the exceptions of the Fatimite Moors and the French under Bonaparte, all the invaders—Cambyses, Alexander, the first Mohammedans, the Ayoubites, and the Turks—have entered by way of Syria. The vitality of independent Egypt, then, can only be assured by means of Syrian limits—its true limits are not at Suez, but in Mount Taurus.

To the list of conquerors who entered Egypt not by way of Syria, may be added Tirhaka the Ethiopian, the Romans, the English battalions, and the Sepoys. But why refer to Cambyses and Alexander? Is it not evident that political power is not distributed now as it was in antiquity? The nations by which Egypt is most likely to be coerced are not those separated from that country by the Syrian deserts. But the whole argument is, in the highest degree, puerile and absurd. If Syria defends Egypt, what is to defend Syria? Mount Taurus is no better defence than the Alps and Pyrenees and Balkan have proved to be. In the extent of its exposed frontier, Syria is incomparably weaker than Egypt; but then it has a long extent of sea-coast, which Mohammed Aly covets, and which is the real object of his ambitious manœuvres.

It is worth while to examine attentively the argument chiefly insisted on at the present junc-

ture by the advocates of the Egyptian Viceroy, and which Clot-Bey thus states:—"Whatever be the oppression now existing in Egypt, it must last till the political existence of Mohammed Aly and his dynasty be solemnly established; and ameliorations must be the infallible result of the determination of this question." This is stating, in plain terms, that personal aggrandisement is the object which Mohammed Aly has always had in view, and for the attainment of which he has sacrificed the well-being of the Egyptians. It is also declaring, that the reforms called for by enlightened humanity, and not by political expediencies, as yet exist only in the promises of one who has reached his seventy-first year, and has been for thirty-five years in the possession of sovereign power. The fact is, that Mohammed Aly possesses great shrewdness, courage, and activity, and, with able tuition, might have done wonders: but it was his misfortune to be surrounded by glory-stricken French adventurers, who were totally ignorant of the principles of beneficent government or of sound political economy. Hence, that "poor old man, content with what God has given him," —as he recently described himself, with true Turkish hypocrisy, in his manifesto to the four powers,—has contrived to assemble an army, more or less perfectly organized, of 180,000 men. He has also created a fleet, and grasped at the external marks and ostentatious results of advanced civilization, while he has utterly disregarded the root and foundation of all national greatness—the prosperity of the industrious classes. His evil counsellors have, at last, led him into a false position, from which he cannot, by any show of obstinacy or dogged pride, extricate himself without submission. We sincerely hope that his qualified demand of Syria for life will not be listened to. It is too bad to hand over nations with diplomatic coolness to be pillaged and oppressed, as Syria will inevitably be, if consigned to Mohammed Aly on the brief and unstable tenure of his own life.

Inedited Correspondence of Henry IV. of France with the Landgrave of Hesse—[*Correspondance Inédite, &c. accompagnée des Notes et Eclaircissemens Historiques*]. Par M. de Rommel. Paris, Jules Renouard.

The work before us comprises the private and confidential correspondence of the celebrated Henry IV. with one of the chief agents of the reformed party in Germany, Maurice the Learned, Landgrave of Hesse, between the years 1601 and 1609. These letters, now for the first time published, and indeed, but lately brought to light, have been preserved among the archives of Hesse, and are now presented to the world by M. de Rommel, keeper of the archives and of the public library of Cassel, with a view to illustrate the history of a very eventful period, and the policy of one of the most illustrious monarchs of his time. With the name and actions of Henry IV. the reader is sufficiently acquainted; but of the Prince, to whom he seems to have confided his most secret political views, a short notice may not be unacceptable. Maurice the Learned was the son of William, surnamed the Wise, himself a zealous Protestant, and attached friend of the Queen of Navarre and her son. This father he succeeded in 1592, and having been brought up in habits of the strictest intimacy with the leaders of the reformed party, he speedily became a devoted friend of Elizabeth, and, subsequently, of Henry. According to M. de Rommel, he was a sort of "admirable Crichton," for he was "orator, philologist, philosopher, chemist, mathematician, theologian, poet, dramatist, composer of music, reformer of schools, founder, and even director, of an academy at Cassel"; and his funeral eulogy "was pronounced by twenty schools of learning." The recantation of Henry, in 1593, seems to have excited the suspicions of the Landgrave, as it did of most of the princes of the reformed faith, and for some years after he held back from his alliance. The events of succeeding years, however, proved to the Landgrave the value of Henry's friendship; "the overbearing and re-active spirit of the whole house of Hapsburg, the feeble and changeful conduct of the Emperor Rodolph, contrasted with the energetic progress, the enlightened views and principles of Henry, began by little and little to induce him to consider that great king as the main support of his house, his party, and of all Christendom." He, therefore, in 1602, proceeded incognito to France; and in several private interviews with Henry, the various points which were the basis of what was termed by them "the common cause," were discussed, and the close and confidential correspondence commenced which is now given to the world. The state of continental politics is well described in the following passage, from the introduction of the intelligent editor:—

Since the great Reformation, the whole of the Christian republic [a phrase then in frequent use] became divided into two parties, the one represented by the Protestants, progressive and liberal, but feeble from the insulation of its adherents and their many differences; the other, conservative, and even re-active, but more compact, more united, and under the guidance of the Pope, the Germanic Emperor, and the Spanish monarchy. The collision of these parties on questions of the utmost importance to the social condition of Europe, created a general excitement, while a crisis, as universal as dangerous, was preparing in its political relations. The European balance of power was menaced from the moment that the Spanish monarchy, the most despotic in Europe, and the hereditary and elective kingdoms of Austria were united to the imperial crown in the same family, and on the head of Charles V. The Queen of England, Elizabeth, was the first to perceive that the subjugation of the Protestant party must injure the European equilibrium, by menacing the political and religious freedom of all those nations which, since the Reformation, had ranged themselves gradually on the side of Protestantism,—whether they possessed the privileges of an elective monarchy, as Hungary and Bohemia, or whether under the form of a republican confederation, like the United Provinces. Therefore it was that during the political and religious war of the United Provinces against Spanish domination, she hastened to aid that rising republic, foreseeing that from its preservation and its independence the triumph of the great interests of Protestantism and of the European balance of power would principally result. This great inheritance—the guardianship of the Christian republic—devolved upon Henry IV., from the time that he was summoned to place France again in the rank which was assigned to her among European nations. Such a prince accepted without hesitation so glorious a mission: love of the human race, the just principles of government, the confidence which he had in his own talents, and perhaps, also, a remembrance of his wrongs, all combined to induce him to take under his protection, and to defend vigorously against the Papal and Spanish party, the interests of those princes of the empire, who had so constantly aided him in the struggle which he had so long been called on to sustain.

Henry, indeed, seems very early to have formed the project of a general confederation of Protestant states, to be called "The most Christian Union," and of which he certainly intended to be the head;—another proof that his renunciation of Protestantism was a proceeding in the sincerity of which no one believed. Hostility to Spain, however, from whose machinations he had so long suffered, and a desire to humiliate the house of Hapsburg, and to unite to France some of the most important towns of the Netherlands, were motives quite sufficient to account for the eagerness with which he pursued this plan, without adding "love for the human race." Henry was a pleasant man in private life, and as kind-hearted, perhaps, as a voluptuary could be; but he was no more inclined to make sacrifices for the welfare of Europe, or to undertake perilous services for the good of mankind alone, than Philip of Spain or James of England.

The importance of the co-operation of the Landgrave of Hesse in his designs, was early felt by Henry, who, in 1597, dispatched the counsellor Ancel to Hesse, to endeavour to win him to his views. The Landgrave, however, deferred his answer, but Henry still continued his importunities, and invited him to Paris for the purpose of taking counsel with him. The projected journey of the Landgrave was from time to time postponed, but at length, in June 1602, he set out; and the journal, which is still extant, of his proceedings, and of which a portion is here published, is not without interest, from the occasional characteristics it affords of the times.

The Landgrave proceeded by Frankfort, Worms, and Spire, to Tubingen, where he sustained a theological discussion with the university, and, from the facility with which he spoke English, was taken for an English nobleman. He then proceeded to Switzerland, where he often took up his abode at inns, where milk and cheese were the only provisions he could procure; and when arrived at Geneva, he was introduced to Theodore Beza, and at his departure he celebrated the praises of that city in an elaborate copy of Latin verses. Following the course of the Rhone, he proceeded through the middle provinces of France, noting the curious plants, the antiquities, the fortifications, and whatever else excited his attention. He then took his route along the southern parts, returning through Orleans and Chartres, whose magnificent cathedral, iconoclast as he was by religious profession, he had the taste to admire; and he arrived at the close of September at Fontainbleau, his account of which, and of his stay in Paris, shall now be given:—

Fontainbleau is a very pleasant and beautiful castle, and I was enabled to examine it more in detail, because the king, who had appointed to meet me there, had not arrived. There are four quadrangles here; the court of the king, of the queen, of the fountain, and a grand lower court, which is five hundred feet square, and ornamented by a plaster equestrian statue of Louis XII., placed in the middle. In this castle we find many marble staircases, four grand saloons, and galleries of superb pictures and antiquities; besides these, there are gardens and fountains, and two houses for tennis, and an aviary containing 5,000 birds, both for song and for eating. On the morrow, after having slept at Melun, passing Charenton, where we heard a celebrated echo, I arrived in Paris, and went to lodge at the hotel of the "Red Bell," Rue St. Jacques, and afterwards at that of the "Ville d'Anvers." I caused notice of my arrival to be made to the king, who appointed me a place withoutside Paris. On the 28th Sept. I set out to visit the public buildings and most remarkable things in this capital, that is to say, the Tuilleries, built by the queen mother (Catherine), and continued by the present king, the stables, the academy, the palace, the Louvre, the church of Notre Dame, &c., and in the evening I visited the Ambassador of Wirtemberg. On the 29th, I went in the morning to the arsenal, to have a secret conference with M. de Rosny (Sully), after which, by desire of the king, passing by the Castle of Madrid, (built by Francis I. in hostility to Charles V.) I went to Maisons, a residence adorned with handsome apartments, galleries, terraces, walks, and other pleasant things, belonging to M. Langeur, superintendent of accounts, one of the favourites of the king, and an Huguenot in religion, but a Catholic in politics. On the 30th, the king, having wandered from the chace, visited me privately, accompanied by three gentlemen. After a long conversation, he directed the

carrée to be given to the dogs, and I then explained to him the difference between the German modes of hunting and the French. On the 1st of October I went to St. Germain-en-Laye, a new built mansion, where, while I was visiting the different remarkable things, the platform, fountains, grottoes, &c., the king unexpectedly came. After a conference of some hours, he ordered some of his lords, particularly the Dukes of Montpensier and d'Aiguillon, to pay their respects to me. Afterwards, when the king went to visit a convent of religious women, at Poissy, I visited the queen (Mary de Medicis) and the dauphin in the old castle, and then returned to Maisons. On the morrow I set out for St. Denis, where I saw the market well attended; they showed me in this city the cathedral, and the tombs of the kings, and the treasury filled with royal apparel and ornaments;—the sceptre, the sword, the crowns, the helmet, the great vase for holy water, of porphyry, the unicorn,—[This, we suppose, means the precious piece of unicorn's horn, said to have been presented to the treasury of St. Denis by Suger, and which for many centuries was considered as one of its chief ornaments]—the lantern of Malchus, many chalices and valuable cups, crosses, ostensories, and other holy fooleries (*bouffonneries*). In the evening I returned to Paris, where I found the Swiss deputies, who had just arrived. On the 5th they made their solemn entry, conducted by the Duke de Montbazon: I witnessed this with the king and queen in the house of Zamet, an Italian, which is often frequented by the king; it is adorned with superb tapestry valued at 400,000 florins. On the 6th, the Swiss, according to ancient usages, were entertained by the chancellor, M. Bellièvre, during which the king gave me audience for the third time in his cabinet, in which are a great number of pictures, of antiquities, and ancient books and manuscripts, among which he showed me an ancient French bible, where are the signatures of all the kings of France since Charles V. [this may still be seen in the Bibliothèque du Roi.] On the morrow I was present at the audience of the Swiss in the chamber of the king, from whence I passed to the Louvre, and saw the king and queen at table. On the 10th, I saw the valuable horses with an English groom, and the Ambassadors of England and the Netherlands. On the 11th, I assisted at the ceremony of the oath made by the king to the deputies of the Swiss confederation in the church of Notre Dame, where the Bishop of Vienne sung the mass, and the Cardinal de Joyeuse performed the other ceremonies.—[From the journal of Pierre de l'Etoile, we find that as soon as the mass commenced the Swiss retired, one after another, after having made a profound obeisance to the king, and went to the nave, where the Landgrave, and the administrator of the bishopric of Strasburg, and several others of the reformed faith, were; and they all remained there with their hats on until the mass was finished. Then, and not until then, did the Swiss and the Landgrave return into the choir and take their former places.]—The ceremony being finished, I assisted in the archbishop's palace, at the dinner of the king and queen, after which the king passed into the grand saloon, where the Swiss dined, and there drank their health. At this table were a great number of French princes and nobles—the Princes of Condé and Conty, the Count de Soissons, the Duke de Montpensier, the Constable, M. de Montmorency, the Duke d'Esquillon, and others, even *Mathurine, the female fool of the king*, was there. The Dukes of Maine and de Nemours were excused, but the Count d'Auvergne, chief actor in Biron's conspiracy, who, after his judicial condemnation had obtained the king's mercy, had the impudence to occupy a chair between the Dukes d'Esquillon and de Joinville.

After a few days longer stay the Landgrave took his leave of the King, and returned to Germany, fully pledged to support and assist Henry in the extensive designs which he then meditated. These are developed in the minutes of conversation with the King, which the Landgrave made at the time, and they afford a key to the hints given in Sully's Memoirs, and in other contemporaneous works, of the vast projects which Henry contemplated, and which would have been put in execution but for his death: the following are extracts:—

After a long conversation with Villeroy, the king entered. He conducted me by the hand into the saloon, and immediately inquired of me the state of affairs in Germany. Upon my replying, that alas! his majesty himself knew their sorrowful state, the king replied that he wished the Germanic princes would form a confederation. To this I replied that so salutary a measure had not hitherto been taken, but that I had hopes, provided that he himself would be the basis of the alliance. The king replied that he was well disposed to it, provided the princes themselves agreed to it, desiring to know who were the German princes who would enter into this union. I told him I was assured of the Palatine, of the houses of Brandenburg, Brunswick, Hesse, Baden, Anhalt, and the counts of Wetteravia, but that we had not the same confidence in the courts of Denmark, Mecklenburg, and Pomerania, and that Saxony and Wirtemberg were still irresolute. The king, after having expressed his surprise at the great number of princes and houses which I had named, interrogated me specially on the characters of these persons, and the state of their finances, to which I gave him such explanation as I judged necessary. * * Passing then to another subject, and placing himself before the chimney, he said, that the archduke with his galleys had sustained a great defeat. "Truly," replied I, jestingly, "if the archduke has not better luck, there will remain little hope for him to become King of the Romans." The king then asked me whether the archduke enjoyed much credit in the empire; above all, he asked whether the princes of the empire would wish for an emperor who was not of the House of Austria. To this I merely made a general reply, that is to say, that in a case of necessity no one could blame them; adding, playfully, that it was to be regretted that the power of the king was not yet perfectly consolidated over the French nation, but that several princes of our party inclined towards his majesty. The king, although he did not appear to express any ambition, yet seemed anxious to continue this discourse, but I broke it off. He then led me into the garden, where he gave me occasion to remark how much interest he still felt in the cause of the reformed faith.

After having conversed on the chace, on the game of dice, and other like things, he mounted his horse and assigned a second meeting at St. Germain's:—

On the 1st of October I was conducted to St. Germain, and while I walked on the grand terrace, the king met me with the dukes de Montpensier and d' Esquillon. * * We next passed on to details of the first importance, the union of the German princes, and the election of a king of the Romans. The king, pre-occupied by the opinion of M. Ancel, would not believe the concert between the archduke Albert and the emperor; and, as after my observations he approached rather nearer to my opinion, I showed him the necessity of an embassy to the electors of the empire, as a means of dissuading them from an Austrian election. * * Afterwards the king expressed himself strongly against Bouillon, La Tremouille, and Du Plessis, adding, that many of the reformed faith were still wrapt up in conspiracy. I replied to this with apparent indifference, and led him back to the chief point, so that he at last expressly said to me, "My cousin, you shall go and tell the princes of Germany that you are well assured that I wish them well, and that I will aid you and support you in all; only be you well united, and manage your affairs with discretion."

At a third meeting, after a long conversation, "according to his custom," says the Landgrave, about his hunting, his amours, his wars, and other things, he said, "that he was still devoted to the reformed religion, and that he had even a design, before his end, of making anew a public profession of it," (!)—the hopes of the imperial crown, to be gained through the intervention of the Protestant princes of Germany, we suppose, striking the balance in favour of Protestantism, just as the crown of France had, erewhile, determined him in favour of Catholicism.

From the subsequent letters, we find that this project of the confederation presented greater difficulties than the Landgrave, or even the King, had imagined; and Henry repeatedly expresses his vexation at its slow progress. On the accession of James to the throne of England, the Landgrave expresses his ardent wishes for the prosperity of "the good king," and that "God will please to preserve him many years, in health and peace, to the comfort of his neighbours." He also states, that the ambassadors of the confederate princes have set out with a message of congratulation, and that they await "with great respect, a good and serviceable answer to their business, as I have not the least doubt that the king of England will continue his good will towards them." In this, however, both Henry and the Landgrave were disappointed. From some other hints here, as well as the remarks of Sully, it would seem that Henry, however greatly he might profess to admire Elizabeth, was not distressed at her death; those extensive projects, which he meditated, he well knew would be opposed by that queen, who, if she so willingly aided the Protestants in their struggle against the combined power of Spain and Austria, would surely never allow France to attain, though by Protestant means, an ascendancy equally dangerous to the welfare of Europe. But with James the case was different; that "captain of arts, and clerk of arms," as Henry was accustomed to call him, might be coaxed, flattered, or cajoled into compliance; and hence, probably, the reason of the splendid embassy which he sent. But both the King and the Landgrave seem to have forgotten that weakness is often allied with stubbornness; and they, ere long, found that the gullibility of James cast as many obstacles in their way, as the far-reaching views of Elizabeth might have done. The progress of the negotiations respecting peace between England and Spain, is alluded to in successive letters with an anxiety which shows how important these negotiations were felt to be; and when news arrived that the treaty was signed, the Landgrave expresses his fears that it will "prove of irreparable injury to many of our neighbours, and, it is even to be feared, that since the late queen was maintained by that war both in credit without, and in peace within, he (James) doing otherwise, may probably experience the reverse, which God forbid!" Henry, in his answer to this letter, remarks, "I wish this peace may prove as beneficial to my good brother and ancient ally, as he expects it to be; but unless the Spaniards keep faith better with him than they have with me, he will have no great cause for boasting."

Although evidently much vexed at the conduct of James, Henry pursued his plans, and seems to have hoped that when the time for their developement should come, he would experience at least no opposition from him, even though he should not openly give his aid. In a letter dated Oct. 5th, 1605, he thus refers to the subject, which certainly was the end of his designs; the passage is in cipher:—

For the rest, every one here says, that the princes and electors of the empire are extremely anxious to elect a king of the Romans, being solicited to it from all parts, and principally by the great necessity of the empire. On this there are different opinions as to their choice; the one party wishing the Archduke Albert or Ferdinand, these are the Spanish; the other, Matthias, or Maximilian; and some others, a *prince not of the house of Austria.* I pray you let me know what is said where you are, and what is your advice, and that of our friends upon it; for you know that for my part I am not actuated by any other motives than the promotion of the public weal, which will be always favoured and supported by me most sincerely, as I pray you to cause it to be circulated everywhere, as occasion may serve.

In the Landgrave's answer to this letter he assures Henry that—

I will notify to Mons. the Elector, (the Prince

Palatine) and to all the other princes who have need to know it, the royal resolution of your Majesty, to prefer ever the public weal to all other particular considerations; and will learn of him how and by what form, and in what time and place, the said Lord Elector thinks to make the communication in question. And I will give orders that your Majesty shall be made acquainted with all, as mentioned above, and according to your will. No one can doubt that the King of Great Britain will willingly be of our party; at the least he ought, and for his own benefit. But, inasmuch as it appears that the King of Denmark and the Duke of Brunswick have privately, I know not what design, according to my views it would be as well that we should have a little patience with the King of Great Britain, who must not in the end be omitted.

In a letter a few months later we find Henry urging the Landgrave to press upon the princes in his favour the necessity of a union, menaced as they are by "the arms of the Turks on one side, and those of the King of Spain on the other;" he again refers to his willingness to serve them, adding—

"Not that I intend to engage them in anything prejudicial to the empire, nor to their faith and duty, nor, for the present, to take up arms and quit the repose they now enjoy; nor, either, to spend their money prematurely, but only to prepare themselves, that they may avoid the changes which menace them from these two quarters, and also sustain that part which is their right, at the election of a King of the Romans, when the occasion shall present itself; and let this be understood.

Toward the close of the year (1606) a project of the act of union was prepared, and submitted to the King; in a subsequent letter he speaks of it as being "too general to be of much utility;" to which the Landgrave replies by enumerating the many difficulties he had encountered. In the spring of 1607 the diet having been summoned for April, Henry vehemently urges the completion of this union; the Landgrave, in reply, excuses the delay in consequence of the truce just concluded in the Low Countries, and which was to continue for eight months. At the conclusion of this period, new obstacles arose: the princes were still inclined to hold back, the revolt of the Archduke Matthias followed, the diet was dissolved, and little was effected for many months. The last letter of the Landgrave is dated March, 1609; in it he again expresses his hopes that the union may be finally accomplished. The editor, however, considers it certain that up to a short period before his death, Henry continued his confidential correspondence, and he supplies, as far as he is able, the loss of these letters by the publication of several addresses to the Landgrave by Henry's ministers.

At length the contests between Austria and the allies of Henry (the Prince Palatine of Neubourg, and the Elector of Brandenburg,) determined him to commence the war which he had so long intended, and which he, doubtless, considered would expedite the developement of those designs, which, as we have seen, he had meditated for more than seven years. Summoning the forces of the princes who were favourable to the union to assist him, Henry, in the spring of 1610, prepared to take the command of the army, which consisted of 100,000 men. The letter of Jean de Thumery, his ambassador to the confederate princes, addressed to the Landgrave, and dated on the 6th of May, affords a melancholy example of the "blyndness of our mortal nature," in regard to coming evil. In it he compliments the Landgrave on his devotion to the cause of his master, and adds—

Monsieur the Prince Christian, of Anhalt, has arrived here within three days, having in his road defeated a good number of the Archduke Leopold's people, as you have heard. The beginning promises well, and the wisdom of our leader will not permit our hopes to be vain. The troops of his Majesty will be on the frontier on the 20th, and will only wait until the army shall be ready for the field.

The troops never arrived; for six days after the date of this letter the poignard of Ravaillac ended alike the long-cherished projects of Henry and his life.

OUR LIBRARY TABLE.

The Budget of the Bubble Family, by Lady Lytton Bulwer, 3 vols.

> The earth hath bubbles, as the water hath,
> And these are of them.

—essentially "of the earth, earthy." We thought, as we laboured through the work, of Master Great-heart's description of Madam Bubble:—"She is a great gossip: none can tell of the mischief she doth. She makes variance betwixt rulers and subjects, betwixt parents and children, betwixt neighbour and neighbour, betwixt a man and his wife, betwixt a man and himself,"—and we could not but speculate on the cause which led Lady Bulwer—who blazons forth the fact that she paints from life—to omit in her portraitures of the eccentric, silly, puzzle-headed family, so distinguished a member of it as Madam Bubble herself. The dedication to Mrs. Trollope is a humble imitation of a worn-out style—satire under the guise of compliment. But, though it may be satirical to say that honesty and justice were thought fabulous virtues till Mrs. Trollope crossed the path of the writer, satire changes its character when she adds—"Your unflinching integrity *approaches* [!] *you, on all occasions and under all circumstances, to the divine source from whence it emanates.*" This—assuming that there is no other offence in it—is an exaggeration of which Swift and the masters of the art would never have been guilty. In the preface the author changes her ground,—thanks the critics who disapproved of 'Cheveley,' because "their praise is a blot and their support a degradation." We could adduce numberless other illustrations of the animating spirit of the writer; but, in truth, such follies, though they may set on some silly people to laugh, make us melancholy: as evidence of a half-educated mind, wide wandering, yet conscious of its aberrations. Dedication and preface once passed, the 'Budget' is too dull for comment. It is mere unmitigated farce and caricature. Old Mrs. Manners, the octogenarian of the household, would be nothing without her spelt brogue and lisp;—Sir Romulus, a whimsical conceited projector, is expected to pass current, on the strength of two phrases, the one designating his wife as his "calamity," and the other, in which all opposing persons and circumstances are called "Algerines." Prudence, indeed, with her button-mushroom curls, her fidgetting fingers in their too roomy gloves, her love of good things at other people's cost, and her present of an ugly silver tea-pot to herself on her birthday, is some shades nearer a character—but the whole party, with their friends, the Damnemalls, Mac Phin, and La Perpignon into the bargain, whether exhibiting their absurd vagaries in Shropshire or in Paris, are anything but inviting. They are at best a set of hard, coarse, Dutch tea-board figures, and their absurdities fail to awaken a smile. So, too, the quasi-philosophical passages introduced, will quicken thought in few, notwithstanding the parade of allusions to the Greek epigrammatists—Francisco Lobon de Salazar's admirable book—the great Gassendus—Pliny, &c., &c., &c.—bubbles all. In fact, the book is not written so much in the Dutch style as in the auctioneer's: and the force of cataloguing can no further go than in the description of Mrs. Sutton's first floor. In the story there is little worth unravelling. The drolls to whom we have alluded are far dearer to the author than the gentle heroine, Theresa Manners, or her zealous hero, Cecil Howard. The most powerful passages belong to the episodical story of Carlton, the broken-down actor. But the three volumes are, after all, but a giant bubble, which, by publication, has burst.

A History of British Reptiles, by Thomas Bell, F.R.S., and Professor of Zoology in King's College, London.—We have much pleasure in at length doing justice to this interesting volume, which forms so excellent a companion to the Histories of British Fishes and Birds, of Mr. Yarrell. Although the materials for the present work were but scanty, Prof. Bell has, from his intimate knowledge of the subject, rendered the volume highly interesting. The reptiles themselves, disliked as they are by many persons, look really beautiful in the splendid wood-cuts with which the work is illustrated; and the family groups of the Blind Worm, and especially of the viviparous lizard, as well as the cuts of some of the snakes, are quite equal to the wood-cuts we have had occasion to speak so highly of in Mr. Yarrell's work. From the extraordinary diversity in the structure of these animals, which Mr. Bell proposes to divide into two classes,—the Reptilia and Amphibia,—diversities equally great in their physiological peculiarities exist, and these the author has carefully detailed, noticing a number of remarkable circumstances not generally known, or popularly misunderstood, relative to their habits, economy and physiology. The modifications which occur in the respiratory system, and the mode in which the young of the ovo-viviparous species are produced alive, as well as the transformations of the amphibia, particularly the frog and the newt, are especially described. The synonymy of several species is satisfactorily cleared up, especially the *Zootoca vivipara*, mistaken by all previous English authors (except Jenyns) for the *Lacerta agilis* of Linnæus; and the *Lissobrila palmipes*, and its variety *L. vittalus*. A new British species is also added under the name of *Triton Bebronii*. A new genus is also proposed for the smooth water newts. In the majority of the species we find the deficiency alluded to in our notice of Mr. Yarrell's 'Birds' obviated by the introduction of short generic and specific characters; but we cannot understand why the species of Sphargis, Lacerta, and Zootoca should not have been similarly treated. The edible frog, although a reputed native of Devon (Turton and Kingston), is not introduced.

Spence's Mathematical Essays, Edited by J. F. W. Herschel, Esq., (published in 1820.)—It is quite out of our usual way to notice a work of this date, but peculiar circumstances have prevented even mathematicians from knowing anything about it up to the present time. Mr. Spence, of whom Sir J. Herschel truly said in the preface, that he was "one of the first of the modern English mathematicians who appears to have been deeply impressed with a sense of the vast superiority of the geometers of the continental school," published a well-known work on Logarithmic Transcendents, in 1809. He was engaged in republishing this, with other tracts, when he died, (as we are informed by Mr. John Galt's memoir of him, which accompanies this edition,) May 20, 1815. Sir John (then Mr.) Herschel completed the work, and added notes; the impression belonging to the author's widow. It was sent down into Scotland, with the exception of a very few copies presented to scientific friends by Sir J. Herschel, and from that day, to within a month or two from this time, nobody knew what became of it. The higher students of mathematical literature were aware that such a work once existed, but how it had become unattainable they could not guess. The secondhand booksellers treated the work as one of the rarest character: many of them had never seen it. It occurred to a gentleman engaged in mathematical pursuits, to cause a little inquiry to be made in Scotland, (where, the printer informed him, the whole impression had been sent,) and, sure enough, as people say, all the copies, or most of them, were found to be as safe as brown paper could make them, in the publisher's warehouse at Edinburgh. It is but reasonable, then, that this work should now (in spite of its date) have the advantage of being considered as a new work. It consists of the old tract, augmented; a second on various other transcendents; a third on the integration of linear equations by general series; a fourth on some trigonometrical theorems; a fifth on elimination; a sixth on extension of Parseval's theorem; and an outline of a theory of equations; all with notes by the editor. The whole is worthy of Spence's reputation.

List of New Books.—Hodgkin's Lectures on the Morbid Anatomy of the Serous and Mucous Membranes, Vol. II. Part I. "Mucous Membranes," 8vo. 12*s.* bds.—Waterston's Manual of Commerce, 12mo. 5*s.* hf-bd.—Brereton's Refutation of the First Report of the Constabulary Force Commissioners, 8vo. 7*s.* bd.—The Khalif Haroon-Er-Rashid and the Princess Zobéidéh, a Tale, 12mo. 6*s.* swd.—The Clandestine Marriage, by Miss E. Wallace, 3 vols. crown 8vo. 1*l.* 11*s.* 6*d.* bds.—Fulton's Travelling Sketches in Various Countries, 2 vols. fc. 10*s.* 6*d.* cl.—Cape's Course of Mathe-

matics, Vol. II. Part I. 8vo. 10*s.* 6*d.* cl.—Macaulay's Natural Philosophy, 8vo. 12*s.* 6*d.* cl.—Grant's London Journal, Vol. I. folio. 7*s.* 6*d.* cl.—Newman's Grammar of the Hebrew Language, with Points, 8vo. 5*s.* 6*d.* bds.—Mills's British India, by Prof. H. H. Wilson, Vol. VI. 8vo. 14*s.* cl.—Lumley's Poor Law Cases, 8vo. 10*s.* 6*d.* cl.—Orange's Life of G. Vason, Missionary, of Nottingham, fc. 4*s.* cl.—The Manual Concordance of the New Testament, arranged on a New Plan, 32mo. 3*s.* cl., or 18mo. 4*s.* cl.—Usborne's Guide to Egypt and the Levant, fc. 8vo. 9*s.* cl.—History of a Flirt, by Herself, 3 vols. crown 8vo. 1*l.* 11*s.* 6*d.* bds.—Tanner's Canals and Railroads of the United States, 8vo. 15*s.* cl., crown 8vo. 7*s.* 6*d.* cl.—Tanner's American Traveller, 12mo. 7*s.* 6*d.* cl.—Lizars's Anatomical Plates, new edit. letter-press in folio, 6*l.* 6*s.* hf-bd.—Newman's Parochical Sermons, Vol. III. 3rd edit. 8vo. 10*s.* 6*d.* bds.—Bishop Jolly on the Sunday Services, 3rd edit. 12mo. 6*s.* cl.—Fraser's Walkingame's Arithmetic, new edit. 12mo. 2*s.* sheep.—Bulwer's Works, Vol. IX. 'Last Days of Pompeii,' 6*s.* cl.—James on the Collects, 9th edit. 12mo. 5*s.* bds.—The Cherwell Water-Lily, and other Poems, by the Rev. F. W. Faber, 12mo. 7*s.* 6*d.* cl.—Practice of Navigation, by Lieut. H. Raper, 8vo. 18*s.* bds., or 21*s.* hf-bd.—Smith's Hulsean Lectures, 1839, 7*s.* 6*d.* cl.—Roberts's Village Sermons, Vol. IV. 12mo. 4*s.* 6*d.* cl.—Lardner's Cyclopædia, Vol. CXXVIII. 'Lives of British Admirals,' Vol. V.' 6*s.* cl.—Ragg's Heber, and other Poems, 12mo. 5*s.* cl.—Voice of the Church, 8vo. Vol. I. 10*s.* 6*d.*, Vol. II. 9*s.* 6*d.* cl.—Trimmer's Sacred History, 9th edit. 5 vols. 12mo. 30*s.* cl.—Paine's Medical and Physiological Commentaries, 2 vols. 8vo. 36*s.* cl.—Prout (Dr.) on Stomach and Urinary Diseases, new edit. 8vo. 20*s.* cl.—Waller on the Diseases of the Womb, &c. 8vo. 9*s.* cl.—Budget of the Bubble Family, by Lady Bulwer, 3 vols. post 8vo. 31*s.* 6*d.* bds.—Illustrated Commentary upon the Holy Bible, Vol. I. 'Genesis to Deuteronomy,' post. 8vo. 7*s.* 6*d.* cl.—Texas in 1840, by A. B. Lawrence, 12mo. 6*s.* cl.—Bodin's Summary of the History of France, royal 18mo. 3*s.* cl.—Oliver's (Rev. G.) Theocratic Philosophy of Freemasonry, 8vo. 10*s.* 6*d.* cl.

[ADVERTISEMENT.]—*The Sportsman's Oracle.*—To the Editor of the *Athenæum.*—Having been advertised as a contributor to the '*Sportsman's Oracle,*' published by Messrs. Baily & Co. of Cornhill, allow me, through your Journal, to state that the Oracle contains nothing from my pen except the *reprint* of an article which was written expressly for another work, and appeared therein about two years ago. So much for one, at least, of the "new names" which, according to the preface, have been added to the popular ones who furnished the materials for last year. I am the more anxious to disavow any such imputed contributorship, because it would imply the continuance of a Connexion renounced by me six months since, as religiously as one renounces the devil and all his works. Those only who are aware of my actual position with regard to Mr. Baily can thoroughly estimate the gross impropriety, indelicacy, and offensiveness of using my name in such a manner. The degradation of stooping to derive advantage from a pretended association with a party, legally at issue with him, may, however, be appreciated: whilst anybody can measure the sagacity of a man, who by his own public act, literally compels me to declare as publicly, that nothing should induce me to write a line for any work of which he is publisher or proprietor.—I am yours, &c.,

London, 28 Sept., 1840. THOMAS HOOD.

TENTH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

[*From our own Correspondents.*]

FRIDAY, SEPTEMBER 18.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

'On a Blue Sun seen at Bermuda.'—Sir DAVID BREWSTER said, that the communication which he had to make was contained in a letter from Lieut.-Col. Reid, R.E., who had lately gone out as Governor to the Bermudas, and although the entire letter did not refer to the subject now before the Section, he would read the portion which contained the notice of this remarkable phenomenon, as well as the latter part, which was more immediately connected with a subject likely to create much interest the next day.

Bermuda, 17th August, 1839.

Dear Sir,—I think the accompanying letter, which describes the singular appearance of the sun at Bermuda, which made white objects appear blue, cannot fail to interest you; and if you are able to explain the cause of this, I should be very glad if you would favour me with such explanation. The fact is one familiar to every one here; but I requested Dr. Harvey to put it in writing, expressing what he saw himself, that I might send the account to you. The present collector of the Customs at Bermuda was at sea on the 11th of August, the day the same hurricane was passing over St. Vincent; and to him and to the other persons on board, objects appeared, they thought, of a light green or bluish green colour, and the sun had this same appearance. Their vessel was then 15 miles east of Bermuda.—The hurricane reached Barbadoes a little before midnight on the 10th of August 1831.

Three days ago I had a fine opportunity of observing a water spout under my house, and could, with a spy-glass, distinctly observe that, *at the surface of the sea*, it was revolving like the hands of a watch, and the same observation was made at a telegraph station near government house. This is the fifth account, well authenticated, in north latitude: all five revolved in the same way.

The heat in July and August has been very oppressive; but my family are well, and Mrs. Reid sends her kindest remembrance to yourself and Lady Brewster.

Believe me, dear Sir, yours very faithfully,

WM. REID.

The account referred to in the letter is as follows:

Bermuda, 3rd August, 1839.

Dear Sir,—Not having made any notes at the time, I can only proceed to narrate the circumstances which occurred here in August 1831, from memory. On the 10th of that month the weather was remarkably fair, but as evening drew near a change took place. The sky began to lour, and put on an awful and gloomy appearance. The clouds collected voluminously, and very heavily, in every direction, over the island, indicating a prodigious fall of rain. At this time I do not recollect any threatening of a storm of wind, save a moderately hollow sound of the sea dashing against the shore, but by no means equalling that which we frequently witness at this season of the year, when a storm is impending, or has passed by us. Thunder and lightning began to be severe, and the weather more threatening. Next morning, the 11th, I rose early, for the purpose of writing, and soon discovered the light was so dim I could not proceed. I removed to another room, and finding my situation not improved, I said, in the presence of one of my family, I apprehended a sudden failure of sight. I was then asked if I had not observed a very peculiar appearance of the sun's rays the day before. I had not; but had perceived the floor of the room to look blue, especially where the sun shone on it; indeed, every object in the room appeared of a sickly blue colour. The next day, the 12th, a mail boat was put under weigh for the first time with a party on board. The day was so mild and tranquil, we could only reach a few miles; the sails, which were new and pure white, nevertheless appeared to be stained of a blueish colour, and the sea was of a dingy yellow. On the first arrival from the West Indies we heard of the devastation at Barbadoes, but with us there were no subsequent unusual appearances; on the contrary, we had very fair weather, although I heard this singular blue colour was observed even to the coast of America.

(Signed) AUGUSTUS WM. HARVEY, M.D.

Sir David Brewster observed, that in the course of a series of experiments on the colour of mixed plates, both as produced by the soft solids compressed between plates of glass, and as exhibited in laminæ of sulphate of lime, and other minerals containing strata of minute cavities filled with fluids, he was led to the opinion that the blue colour of the sun was produced in a similar way by vapour or water in a vesicular state, interposed between the sun and the observer. Owing to this cause, the sun may exhibit any colour, and, in point of fact, he had once seen the sun of a bright salmon colour, in which both red and yellow were mixed with the blue. A similar effect is often produced when the sun is seen in a cold winter morning through the windows of a carriage covered with hoar frost, or when it is seen through vapour similarly deposited. Sir David referred to observations of his own published in the *Phil. Trans.* for 1837, in which he had shown that the colours of mixed plates were phenomena of diffraction produced by the edges of transparent bodies separating media of different density.

Prof. FORBES considered that this well authenticated fact afforded a strong confirmation of views he had lately published on the colour of the clouds and sky.—Prof. STEVELLY begged to know whether the hypothesis that clouds and vapour existed in the state of vesicles, or hollow bubble-shaped fibrons, was essential to the optical explanation of this and other phenomena connected with the colour of the clouds?—Prof. Forbes replied, that the hypothesis was no way essential to the explanation, although he admitted that he sometimes used the expression vesicles of water suspended in the air.—Prof. Stevelly said, that he was strongly impressed with the conviction that the constituent particles of cloud were full spherules of water, and not vesicles, and he believed that opinion could be almost demonstrated from the known laws and phenomena of capillary attraction.—Sir D. BREWSTER said, that although he did not assert that the ordinary state of vapour and cloud in the air was that of vesicles, yet well authenticated examples were recorded of quantities of vesicular water being taken up from the sea in severe storms, such as the tornado, which was at the very time of the appearance of this blue sun, raging at Barbadoes, and deposited in places not far removed from the sea. In some instances he had known these vesicles to burst upon the glass panes of windows, and there deposit rings of salt as lasting proofs of their vesicular forms. It was by no means improbable therefore that the air might have been full of such vesicles at the time we were now speaking of.

Sir DAVID BREWSTER then gave in his report 'On the Hourly Meteorological Observations made at Kingussie and at Inverness.'

Having selected Inverness and Kingussie as two suitable stations for carrying out two series of hourly observations with the thermometer and barometer, and prevailed upon the Rev. Mr. Rutherford, of Kingussie, and Mr. Thomas Mackenzie, teacher of Raining's School, Inverness, to undertake these observations, the necessary instruments were made by Mr. Adie, of Edinburgh, under the superintendence of Prof. Forbes, and the observations begun on the 1st of November, 1838, that month being the commencement of the meteorological year, or the first of the group of winter months. While these observations were in progress, I communicated to the Association at Birmingham a specimen of those made at Kingussie, with a brief notice, which is published in the report of last year. I have now the satisfaction of laying before the Association the observations themselves, forming two quarto volumes, a work of stupendous labour, executed, for the first time, by educated individuals, with the aid of properly instructed assistants. The observations made at Kingussie, and, to a certain extent, those made at Inverness, contain ampler details of meteorological phenomena than any series of hourly observations with which we are acquainted. In addition to the thermometrical observations, the height of the barometer, and the temperature of the mercurial column were observed every hour. The general character of the weather was carefully noted. The character and direction of the wind at every hour was recorded. The number of hours of wind, of breeze, of calm, of rain, of snow, and of cloudy and clear weather were regularly marked; and the number and nature of the auroræ boreales were recorded and described. When these observations are compared with those made at Leith under my superintendence for four years, with those made at Plymouth from 1832 to 1840, at the expense of the Association, and under the able superintendence of Mr. Snow Harris, and with those made at Padua, Philadelphia, and in Ceylon, we perceive very distinct traces of meteorological laws, of which no idea had been previously formed; and I have no hesitation in stating, that when this class of observations are multiplied and extended, they will lead to general results of as great importance in predetermining atmospherical changes, as those which have enabled the astronomer to predict the phenomena of the planetary system. Sir David Brewster then proceeded to give a brief and general account of the results obtained from the observations in Invernesshire, leaving the numerical and more minute details for the report which will be published in the Transactions of the Association for this year. In giving an account of the observations on temperature, the results obtained at Kingussie and Inverness were compared with hourly and two-hourly observations made in other places, as exhibited in the following table:

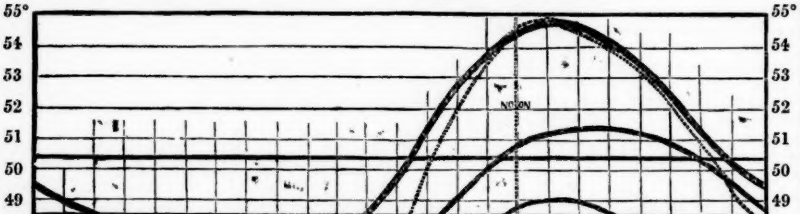
Places of Observation.		Latitude North.	Longitude.	Height above the Sea.	Distance from the Sea.	Mean Temperature.	Time of morning mean.	Time of evening mean.	Interval between morning and evening mean.
Inverness ..	Observations made every hour.	57° 29′ 34″	4° 12′ W.	92 feet	1 mile	45° 33′	8h. 31m.	7h. 44m.	11h. 13m.
Kingussie ..		57 4 0	4 5	750	40 miles	48 77	8 51	7 35	10 44
Leith		55 56 0	3 13 W.	25	600 feet	48 0	9 13	8 27	11 14
Plymouth ..		50 21 0	4 6 W.	75	400 feet	52 0	8 0	7 0	11 0
Padua......		45 36 0	11 55 E.	—	—	—	8 41	7 52	11 14
Philadelphia		39 57 0	75 9 W.	—	—	49 28	8 10	7 30	11 20
Colombo....	Ditto every two hours.	6 57 0	80 0 E.	36	near 2 mi.	80 16	10 35	9 30	10 55
Kandy		7 18 0	80 49 E.	1682	—	74 5	10 0	9 0	11 0
Trincomalee		8 33 0	81 24 E.	60	—	81 0	10 35	8 40	11 5
								Mean of all......	11 5

From this table it appears the mean value of the critical interval is 11h. 5m., differing only 8 minutes from the result which Sir David Brewster first obtained from the hourly observations. Sir David stated to the Section, that since the Association met he had obtained from Mr. Caldecott (then present),

Astronomer to H. R. Highness the Rajah of Travancore, the result of a series of hourly observations made at the Observatory of Trevandrum, situated in east long. 5h. 8m., and north lat. 8° 30′ 35″. These observations were made in consequence of the Rajah having seen the recommendation to establish hourly observations in the first volume of the reports of the British Association. The hours of mean temperature obtained from these valuable observations are—

Morning mean	....	8h. 34.5m.
Evening mean	....	7 31.
Critical interval	......	10h. 56.5m.

Agreeing within 8½ minutes of the mean results given in the preceding table.—Sir David Brewster next directed the attention of the Section to the following representation of the mean annual curve of daily temperature at Plymouth, Leith, Inverness, Kingussie, and Trevandrum.



He pointed out the similarity (approaching to almost entire coincidence) between the curves of Kingussie and Plymouth—an elevation of 750 feet above the sea, producing the same effect as a diminution of latitude of six degrees. He also drew the attention of the Section to the curves of Trevandrum* (marked by a dotted line), in which the daily range for the annual curve greatly exceeds that of all the other curves in the diagram,—a new result which no person could have anticipated.

Barometrical Observations.—Sir D. Brewster then proceeded to give a general account of the barometrical observations. The daily oscillations which they indicated correspond both in time and in importance with those which had been made in other parts of the world; but as the corrections had not yet been applied to all the observations, it was deemed unnecessary to make a more minute statement.

Observations on the Wind.—In comparing the number of hours of calm throughout the year, it appeared that they occurred when the temperature was lowest, and upon laying them down in a curve, this curve was almost exactly the reverse of that of the mean daily temperature for the year; that is, the wind, or the commotions in the atmosphere, depends on and varies with the temperature. "This very important and new result (Sir D. Brewster remarked) is confirmed in a remarkable manner by the observations of Mr. Osler at Birmingham, which I have seen since I arrived in Glasgow: observations of inestimable value, which were made at the request and expense of the British Association, and exhibit more important results respecting the phenomena and laws of wind than any which have been obtained since meteorology became one of the physical sciences." The Kingussie and Inverness observations contain many curious observations on the auroræ boreales, and other atmospherical phenomena.

'On the comparative force of the Wind during the twenty-four hours,' by Mr. Osler.

Mr. Follett Osler brought forward a paper in which he gave the results of his investigations respecting the direction and force of the wind, deduced from the mean of 26,000 hourly observations, taken by the anemometer at the Philosophical Institution at Birmingham, during the years 1837, 8, and 9.

We extract one of Mr. Osler's tables.

Table showing the Relative Force of the Wind for each hour of the day, distinguishing the Seasons; from a mean of the years 1837, 8, and 9.

	1 A.M.	2	3	4	5	6	7	8	9	10	11	12	1 P.M.	2	3	4	5	6	7	8	9	10	11	12
Winter Quarter	55	54	49	47	47	48	48	51	50	67	73	82	89	89	85	70	75	65	63	63	63	59	61	57
Spring Quarter	26	28	28	27	29	29	32	41	56	70	80	82	90	89	89	80	81	72	52	45	46	38	33	29
Summer Quarter	19	19	19	19	22	20	18	21	25	40	47	55	58	54	53	44	34	28	27	24	22	19	21	20
Autumn Quarter	19	19	19	19	22	20	18	21	26	40	47	55	58	54	53	44	34	28	27	24	22	20	21	20
Totals	119	120	115	112	120	117	116	134	157	217	247	274	295	286	280	247	224	193	169	156	153	136	136	126

As direction is not regarded in this table, a total of more than one thousand observations is given for each hour of the day. In tabulating these, the curve obtained is found to be almost identical with that of the thermometer—not only for the whole year, but for each season. The increase in the temperature, however, precedes the rise of the wind by a short interval, until it has attained its maximum force; but as evening approaches, the wind declines more rapidly than the temperature. Other tables were brought forward, and diagrams exhibited, in which the total force of the wind was subdivided into sixteen points of the compass, so as to give to each wind its respective character and amount.

Mr. Scott Russell observed, that as it appeared likely that many register wind gauges would be erected, he wished to submit to Mr. Osler and the Section, whether a great improvement might not be effected by removing the spiral springs, and flat surfaces used, and adopting the pneumatic pressure of a pipe turned towards the wind, on the plan of Mr. Adie. This method was one which could suffer no derangement, and would give a much more constant and general indication than the one adopted by Mr. Osler.—Mr. Osler replied, that he had tried to use the hydrostatic pressure of water instead of a spring, and had consulted Mr. Snow Harris on the subject; but they had come to the conclusion, that although high winds might be indicated by such an instrument, yet, from the resistance to the propagation of motions through tubes of the necessary length, the indications of the force of the wind in light breezes could not be relied on; besides, simplicity was so important, and the spring so simple and so little liable to derangement, that, under all circumstances, he was inclined to retain it, unless a very strong case could be made out in favour of any other mode.—Mr. Russell replied, that when Mr. Osler had put the instrument he recommended to the test of actual trial, he would, he felt little doubt, become a convert to its superior simplicity; and with respect to its sensibility, the modification he recommended was sensible to a degree scarcely to be conceived by those who had not actually tried it.—Prof. Forbes thought the use of the spring was an objection in Mr. Osler's instrument; and without entering very deeply into the grounds of the objection, he thought it must be at once obvious that the rushing force of a fluid in motion, could not be measured correctly by a mere statical instrument such as a spring.—Mr. Roberts, of Manchester, mentioned that he had a clock so constructed as to register at every instant of every day, six most important meteorological elements,—the barometer, the thermometer, the pluviameter, the anemoscope, the direction of the wind, and the hygrometric state of the air.

Mr. Caldecott then made a communication respecting an Hourly register of Meteorological Observations kept at Trevandrum. He described minutely the building in which the observations were made, the instruments used, and the registers which accompanied his communication; these observations have been made every hour since the commencement of June 1837, are still in progress, and are intended to be extended to a period of five years from their commencement. The Observatory was erected by the Rajah of Travancore, and is situated in latitude 8° 30′ 35″ north, longitude 5h. 8m. east of Greenwich, 170 feet above the level of the sea, and distant from it, in a direct line, about two miles. Every precaution appears to have been taken to insure accuracy; and of the observers (all natives of India) Mr. Caldecott remarks, that "after the first difficulty of instructing them is surmounted, their patient, diligent, and temperate habits peculiarly fit them for the office here required of them, and I have always found those who have been selected for the duty fully as trustworthy as, I imagine, is any class of persons to whom such observations are usually intrusted."—The registers are arranged in monthly tables, and contain, among other determinations, the following particulars, clearly shown, and ready for any investigation to which they may be considered applicable.

1st. In "Temperature."
1. The mean of each hour for the month.
2. The mean of each day of the month.
3. The same two means for each period of 10 days.
4. The mean range for the month, and for each 10 days; the extreme range, &c.

2nd. In "Pressure."
1. The mean pressure of each hour for the month.
2. The mean pressure of each day of the month.
3. The same two means for each period of 10 days.
4. The maximum and minimum pressure of each day, with the extreme variation for each day; the maximum and minimum pressure of the month, with the extreme variation for the month, &c.
5. The four semi-oscillations for each 24 hours, with the mean values of them for the month.

3rd. In "Humidity."
1. The temperature of the air each hour (repeated from the register of temperature).
2. The depression of the wet-bulb thermometer for ditto.
3. The dew point for each hour, calculated from Prof. Apjohn's formula, disregarding his corrections for pressure.
4. The mean of all these for each day.
5. The quantity of rain for each 12 hours.

Besides these monthly registers, the author exhibited two tables drawn up in the form adopted by Sir David Brewster, showing for the complete year of the observations, viz. from June 1837 to June 1838,

1st. The daily and monthly mean temperature. } from 8,760
2ndly. The mean temperature of each hour, for each month, and for the whole twelve months. } observations.

Also two other tables showing for the same period—
1st. The daily and monthly dew points. } ditto.
2ndly. The mean dew point of each hour for each month, and for the whole 12 months. }

* The latitude is reduced 30°, so as to bring this curve among the other curves.

The first two tables give for the mean temperature of the station, 78°.89, and the other two give for the mean dew point 71°.78.

The barometric registers give, by a mean of all the diurnal semi-oscillations for the same period, the following results:

Fall between	10 A.M. and	4 P.M.	....	0.109 inch.
Rise —	4 P.M.	10 A.M.	....	0.108
Fall —	10 A.M.	4 A.M.	....	0.071
Rise —	4 A.M.	10 A.M.	....	0.073

Times of maxima between the hours of 9 and 10 morning and evening.

Times of minima between those of 3 and 4 afternoon and morning.

Mr. Caldecott concluded by observing that he was about to return to his post in India amply furnished with meteorological, magnetical, and astronomical instruments, and added, that should the Committee of the Physical Section see fit to honour him with any suggestions as to points in meteorology, or any other branch of the physical sciences which his local situation and means might enable him to elucidate, he would feel proud to receive its instructions, and would do all in his power to forward its objects.

Prof. Forbes rejoiced to find that the influence of the British Association was felt even within the palaces of the native princes of India. There was one circumstance connected with these registers which called for particular admiration, and that was, that they contained the observations not merely in the original state in which they were made, but in the very reduced form in which they were to be applied with a view to deduce the general laws from them. With respect, however, to the deduction of the dew point from the indication of the moist bulb thermometer, he would observe, that it was not the dew point which speculative meteorologists wanted, but the force or tension of the vapour contained in the air, for the obtaining of which the dew point was only the preliminary step; and he mentioned this in order that persons engaged in such reductions should at once determine and set down the force or tension of the vapour, which was just as easy to be done at the time of making the reduction.

Mr. Scott Russell then read the 'Report of the Committee on Waves.' All the objects which had been confided to this Committee, (consisting of Sir John Robison and himself,) having been fully accomplished, the Report now presented was to be considered as final. The objects originally committed to them for investigation were:—The phenomena of Waves propagated in Liquids; the connexion of these phenomena with the resistance of Liquids to the motion of Floating Bodies; and the nature of the connexion which subsists between the Tidal Wave and Mr. Russell's great Solitary Wave of Translation. Since the publication of their former Report, the phenomena of waves had occupied the attention of eminent mathematicians, who had endeavoured to deduce from first principles the curious phenomena which the Committee had observed, so as to reconcile theory with experiment. The Astronomer Royal, Mr. Green, and Prof. Kelland had all been engaged on the subject, and the two latter had published Memoirs in the Transactions of Cambridge and Edinburgh, in which they had succeeded in obtaining from analysis many of the very singular results published in the former Report of the Committee. There still, however, remained difficulties which they had not been able to conquer; but as Mr. Kelland was about to lay before the Section his own investigations, it had become unnecessary to include them in this Report. The subject which had chiefly engaged the Committee during last year, was the conclusion and discussion of observations on the tidal wave of the Frith of Forth. This tidal wave presented some very singular features, and, for the purpose of determining its phenomena, a standard line had been levelled with great accuracy under the direction of Mr. James Adem, C.E., and observations made at a great number of stations, the rise and fall of the tide being observed every five minutes. In this channel was observed the singular phenomena of four tides, or two double tides every day; and on some occasions six tides, or two triple tides, were observed. These had all been accurately laid down from the levels, and it appeared that the top of high water rose at Stirling to the height of sometimes as much as ten feet above the level of the tides at Leith. —Mr. Russell had formerly intimated his expectation that this second tide was the great southern tide wave of the English Channel, entering the Forth before the northern tide wave coming round by the Shetland Islands, and afterwards exaggerated, first by the dislocation of the wave, and next by the narrowing of the Channel: and the velocities of these respective waves appeared to be just what was necessary to this effect. He had also found a similar appearance in the tide wave of the river Tay, which he attributed to the same cause. These phenomena appeared to throw considerable light on the mechanical constitution of tidal waves. It appeared that like the great wave of translation, tidal waves could not only meet and cross each other without losing their individuality, but that they could also pass over each other when going in the same direction.

That part of the duties of the Committee which related to the connexion of the phenomena of Waves with the Resistance of Fluids to Solids, had devolved upon them under a separate name, as the Committee on Forms of Vessels, and would be reported under a separate head. The wave form of vessel, however, had been now proved to possess so many advantages, that its use seemed likely to become general, and thus a great change would be effected in naval architecture.

In reply to the observations of Mr. Whewell, Mr. Russell stated, that on arranging the tide waves of the Forth according to the moon's age, the phenomena of the double tides manifested themselves most strikingly at spring tides, and gradually disappeared in the neap tides.

Mr. Whewell remarked, that the diagrams exhibited by Mr. Russell required to be arranged and discussed according to the age of the moon, since it was evident that the differences on different days depended upon the depth of the water; that is, upon the difference between spring and neap tides. The differences were of this kind: the wave is always single at Trinity; at Blackgrange it is double on the 1st, 2nd, 3rd, 4th, 5th days of April; on the 8th, 9th, 10th, it is single; on the 11th, 12th, it is again double; while at Stirling it is always single. In order to obtain the laws of these phenomena, the mean curve of rise and fall at each place ought to be determined *for every period of the semi-lunation*, to which mean curve we may expect that the actual curve every day will very nearly approximate. Two months or more of tide observations at Trinity, Blackgrange, and Stirling, would give sufficient materials for such a discussion. Mr. Whewell further observed, that the separation of two waves (one moving faster than the other) would be theoretically possible, if the *type* of the motion of the parts of the wave were different for the two waves. The circumstance that the surface of the water at high water at Stirling is eight feet higher than at Edinburgh, does not bear any analogy to the high tide in the upper parts of the Bristol Channel; for when a river has assumed a *steady* motion with a sloping surface, any undulation will be propagated along the surface from the lower to the upper parts, just as if the fluid were at rest. Mr. Whewell further stated, that a curious feature in his map of co-tidal lines had been recently confirmed by observation. He had stated, as the result of his survey, that the tide wave must have a rotatory motion in the southern parts of the German Ocean, travelling southwards along the coasts of Norfolk and Suffolk, then crossing over to the coast of Holland, and travelling along that coast from south to north. Hence it follows, that at a certain point of the sea, between England and Holland, there is *no tide*,—the surface neither rising nor falling. It appears that Capt. Hewitt, in his survey of the German Ocean, has recently discovered a place where the rise and fall in the twenty-four hours is so small, that it may be considered as not existing.

'On the Theory of Waves,' by the Rev. Prof. Kelland.

The objects of the present communication are two-fold:—First, to present the subject of the theory of waves in its present form; and then to point out the difficulty which appears likely to impede its progress. The object of the theory is to account, on mechanical considerations, for such phenomena as are presented by the destruction of equilibrium of a fluid, and to obtain and to interpret mathematical expressions which give the velocity, form, impulses, and other circumstances of the motion. Our problem, then, divides itself into two parts:—1st. The determination of the conditions which are presented by the nature of the fluid, on the hypothesis that it *is* in motion; 2ndly, The investigation of the effects which will *immediately* follow the disturbance of equilibrium. The first of these problems alone, presents no considerable difficulty; at least, the difficulties are not such as to have deterred many writers from engaging to solve it. Laplace led the way, and was followed by Lagrange, Poisson, and others. As far as the author knows, however, all the writers on the subject confine themselves to two cases,—viz. when the depth of the fluid is either very great or very small in comparison with the length of a wave. Aided by their discoveries, he attempted, in a memoir read before the Royal Society of Edinburgh last year, and published in vol. 14 of their Transactions, to supply the deficiency, and to obtain the equations of motion of a regular set of waves, without imposing any restriction on the conditions. This was effected by assuming that a reciprocating function can always be expanded in a series of sines and cosines of multiples of the space through which the whole series of values extends. This assumption, which is frequently made by Fourier and others, leads directly to the complete solution of the problem. The author has since applied himself to the completion of this part of the subject, by solving the problem in cases in which the depth is variable, which had only been partially executed before. In the first place, he considers that case in which the depth is variable in the direction of the breadth, but uniform in that of the length. In his former memoir he contented himself with an approximate solution founded on a particular hypothesis. His results, approximate as they confessedly were, agreed remarkably well with the experiments of Mr. Russell. His present more complete formulæ are such, that for all cases in which the form of the canal is expressed by an equation between a power of y and a power of x, they lead precisely to the results which he previously obtained. One remarkable circumstance he pointed out, which is this: that if the form of the wave can be expressed by a *single* function, the velocity is the same in the middle of the canal as at the edges. Perhaps this apparently anomalous conclusion may arise from the circumstance, that we assume the same form of wave to pertain to all parts of the canal. Another result of his analysis is, that the height of the wave increases very rapidly as we proceed towards the edge of the vessel; to the detriment, as it would appear, of the height of the centre. He next endeavours to obtain the motion of a wave in a canal, the depth of which is continually but slowly varying in the direction of the length. He here employs the method of the variation of parameters, and obtains the following results:—1st. That the length of the wave is in direct proportion to the depth; 2nd. That the velocity of transmission at *any* point varies as the square root of the depth; 3rd. The elevation of the crest of the wave varies reciprocally as the total depth of the fluid; lastly, he discusses the problem which MM. Poisson and Cauchy had solved for the particular case where the depth is very small or very great. It is well known that these philosophers undertook the solution of this problem in competition for the prize offered by the French Institute. As neither of these memoirs is printed exactly as it was originally delivered in, it would be hard to draw any conclusions from the judgment pronounced by the judges. We know that M. Fourier found fault with Poisson's solution, on the ground that the function was limited in its value. The prize was accordingly adjudged to Cauchy. The plan which Poisson adopts, it is very easy to understand:—viz. he finds a solution of the general equation of wave motion, and arranges it so as to make it coincide with a formula given by Fourier, which expresses the relation between a function and a particular value of the function. M. Cauchy, on the other hand, demonstrates a formula slightly differing from Fourier's, and by means of it, he too expresses the general function in terms of the particular. Now, it happens that M. Cauchy's formula does not render necessary any limitation as to the depth of the fluid. Indeed, M. Cauchy himself discovered this, and published it in a note; but he never, to the author's knowledge, made any further use of it. Some of the results obtained by both philosophers were found by the author to be true, without all the limitations which they have imposed. But there is one point of the utmost importance,—viz. the determination of

the length of the wave, for which their results are not satisfactory. Those who are acquainted with the analysis employed by the philosophers referred to, will remember that the integrals to be obtained, may, by arranging them in different forms, be made to express different motions. Thus, the *ondes dentelées*, and the waves of constant transmission, are alike expressed, and their *length* is determined in a function of the disturbance, &c. Now, it appears to the author, that the same expansion which leads to the waves of constant transmission, ought, when the circumstances of the motion are assumed to be such as to admit of it, to lead also to the wave of solitary translation. If it do not, then it would appear that the theorems of Fourier and Cauchy cannot give in terms of x a discontinuous function of the nature required,—viz. such, that its differentials with respect to x and y shall vanish at the same time. If, on the other hand, the theorems do suffice to express the requisite function, then shall we expect to find not the velocity only, but the complete *form* of the wave which results from a given disturbance. We shall, in fact, be furnished with the length of the wave. It ought to be stated, that the author has sought in vain to deduce it from the equation which gives the velocity of transmission; and with as little success from the *value* of the discontinuous function which he used in his first memoir. But with the general formula itself, although he has not positively ascertained the impossibility of discovering the thing sought for, he has yet found considerable difficulties. The principal of these is, the multitude of series which must be accurately summed before the equations can be formed. He was in consequence led to point out such difficulties to the Association, with the hope that some member might take up the subject, and, by removing them, render the subject susceptible of application to the theory of the tides.

Mr. Scott Russell expressed great pleasure at hearing that Mr. Kelland's investigations had been attended with so much success. The characteristic phenomena of the great solitary wave were, first of all, the motion of the particles forward only in one direction, and, secondly, their being brought absolutely to rest at the end of a single transit. Both of these phenomena Mr. Kelland had obtained from his analysis. Another phenomenon which he had obtained was one which, even on the most simple consideration, one might suppose to involve an impossibility, viz. the unity of a wave which moved along a channel in which the depth in the cross section was very far from uniform, as in the case of a triangular section. One would have supposed, that the different parts of the wave would only move with the height due to the depth at their own place: here, however, both theory and experiment coincided. In reference to the triangular channel, Mr. Russell had repeated the experiments lately on a larger scale, and found, that while Mr. Kelland's views gave in a certain case 5.00 feet per second as the velocity, experiment gave 5.25 feet, and Mr. Russell's views, with a correction for adhesion, gave 5.55 feet per second—a result not sufficiently decided to close the question, on which he would make further experiment.—Mr. Smith said, there must be some want of generality in the analysis which gave the velocity in a triangular canal equal to that in a square canal of *half* the depth; for, if the breadth of the canal were indefinitely increased, the depth remaining constant, it seemed clear that the velocity of transmission along the centre would approach indefinitely to that in a square canal of *equal* depth; and therefore the velocity given by Mr. Kelland's theory was probably in defect even in less extreme cases.

'On the Expressibility of the Roots of Algebraic Equations,' by Mr. Peebles.—Since the function of the co-efficients which expresses the general root of an equation must be such as to represent all the roots, the author seeks to discover that particular function of n quantities. After proving that various combinations will not suffice, he shows that certain others will do so in certain cases.

Sir David Brewster read a paper 'On Prof. Powell's Measures of the Indices of Refraction for the Lines G and H in the Spectrum.'

At the request of the British Association, Prof. Powell, of Oxford, undertook a series of observations on the refractive indices of different media for the standard lines of the solar spectrum, marked A, B, C, D, E, F, G, and H, in the beautiful drawing of the spectrum executed by Frauenhofer. In consequence of Prof. Powell not having seen this drawing, and having trusted to some very imperfect and reduced copies of it, he mistook the position of the lines G and H, substituting for the former the *mean* of a group of lines situated around G, and for H the middle point between two remarkable bands in the *violet* space, instead of the least refrangible of these bands, to which alone Frauenhofer had affixed the letter H. As these observations were to be employed as a test of the undulatory theory of dispersion, as given by Cauchy and others, it becomes a matter of great importance that the comparison of the theory with observation should be fairly made. With this view, I pointed out, at the Newcastle meeting of the Association, the mistakes committed by Prof. Powell, and exhibited to the Section enlarged drawings of the lines at G and H, taken from a map of the spectrum about *five feet* long, as executed by himself. Prof. Powell, who was not present at that meeting, saw a notice of my observations in the *Athenæum*, and, not appreciating their correctness, he replied to them in that journal; and in various papers since published in the Transactions of the Ashmolean Society and elsewhere, and copied into different newspapers and journals, he has endeavoured to defend or extenuate the mistakes above mentioned. Finding myself thus involved in a controversy with a friend, on a matter upon which no two individuals acquainted with the subject could entertain a different opinion, I am obliged again to communicate to the Section another demonstration of the accuracy of my former statements. In the diagram No. 1,* I have drawn the group of lines round G, which is a *single* line, well marked in the spectrum, and distinctly delineated in Frauenhofer's map. The real line G is not situated in the middle of the group, but much nearer its least refrangible side; and hence the index of refraction, as taken by Prof. Powell from the middle of the group, must have a greater index of refraction than the *real line G*, whose wave length interference spectrum had been determined by Frauenhofer. In reference to the line H, the error is much more serious, as will appear from the diagram No. 2,* in which I have represented the two remarkable bands in the *violet* rays, the *least refrangible* of which is distinctly marked in Frauenhofer's map with the letter H. Between the central lines of these two bands, there are no fewer than *fourteen* lines in the same map. All the observations made by Frauenhofer, both on the common spectrum and the interference spectrum, apply to the central line H of the *least* refrangible of the two bands; but the observations of Prof. Powell, to which I referred at the Newcastle meeting, were all taken from an imaginary line *bisecting* the interval between these two bands, and therefore were of no value as physical data for testing the new theory of dispersion. Prof. Powell has recently given new measures for the real lines G and H, thus admitting the accuracy of my former observations.

'On an Experiment of Interference,' by Prof. Powell.

In the 'London and Edinburgh Philosophical Magazine' for May 1840, a paper appears from Mr. Potter on Fresnel's experiment of interference, &c., in which he details a peculiar method of repeating that experiment, according to which the central stripe of the interference fringes appears *black*, whereas by theory, and in the ordinary form of the experiment, it is *white*. Mr. Potter considers the characteristic circumstance which determines the nature of the result to be this, that "when light, in a state of interference, is made to interfere again, the result is of an opposite character to what it would have been if the light had been in the first instance in its ordinary state:" and the *essential* feature of his form of the experiment appears to be taking as the origin of light, *not* a small hole, or the focus of a lens, (where he contends the light is "in an interfering condition,") but the reflection of the sun from a small convex mirror. He also considers the obtuse prism, as commonly made, not sufficiently delicate for these experiments, and, therefore, prefers the method by reflection. The rays, also, must be received from the convex mirror at an incidence as near the perpendicular as possible. The important services rendered by Mr. Potter in bringing forward fair objections to the wave theory, and his deservedly high reputation as an experimentalist, induce me to request the particular attention of the Physical Section to the case now proposed. The distinction drawn appears to me to require some further elucidation. And as to the experimental fact, I beg to mention, that I possess an obtuse prism, made by Mr. Dollond, which shows the stripes with amply sufficient distinctness to remove all doubt as to the central stripe, especially as by an eye-glass of increased power it is easy to magnify the appearance. Operating with this, and a globule of mercury as the mirror for the origin of light, at an incidence as nearly perpendicular as possible, I invariably see the central stripe *white*. I trust this notice will induce others to repeat the experiment, and especially with micrometrical measurements.

* As exhibited to the Section.

Section B.—CHEMISTRY AND MINERALOGY.

'On the most important Chemical Manufactures carried on in Glasgow and the Neighbourhood;' by Prof. Thomas Thomson, of Glasgow.

Glasgow being the seat of a great many interesting and important chemical manufactures, it occurred to me, (said Prof. Thomson,) that it might be of advantage to those members of the Chemical Section, who have come from a distance, to give a short catalogue of the most important of these manufactures, that they might know what the information is which they may expect, and where they are to look for it.

1. *Iron.*—The smelting of iron has been practised in the neighbourhood of Glasgow, for more than fifty years. The late Mr. Dunlop, of the Clyde Iron Works, informed me, that when he first became proprietor of those works, the produce was only fourteen tons a-week, or 728 tons a-year; and at that time, I rather think, there were no other works in the neighbourhood. At present the quantity of iron smelted in Glasgow and the neigbourhood cannot be much less than 200,000 tons, which approaches to a fifth part of the whole iron smelted in Great Britain. Mr. Dixon has extensive iron works in the suburbs, on the south side of the river, and the Clyde Iron Works are situated on the banks of the river, and about four miles to the east; but the great seat of the iron works is the neighbourhood of Airdrie, or rather Coltsbridge, about nine miles east from Glasgow, but connected with the city by the Monkland canal and the Garnkirk railroad. The ore from which the iron is smelted, is the carbonate of iron, or clay iron-stone, as it is usually called by mineralogists. This ore is very abundant all round Glasgow, and especially in the neighbourhood of Airdrie. Fortunately for the smelters, the iron-stone and coal beds are associated together, the iron-stone either occurring in boulders or beds along with the coal. The rapid increase of iron smelting has been the consequence of a discovery of Mr. Neilson, manager of the gas works. This is now universally known under the name of the hot blast. The air is heated to more than 607° before it enters the furnace, by passing through a range of heated pipes. Under this treatment, it is found, that the coals may be used without previous coking; and that instead of seven tons of coals for every ton of cast iron, three tons or even two and a half tons will suffice. There is also a diminution in the quantity of limestone necessary, and the produce of iron per week from the same furnace is considerably increased. It is said, that neither in Staffordshire, nor in Wales, is the hot blast attended with the same saving of fuel. Till of late years, no bar iron was made in Scotland, the smelters confining themselves to cast iron. About three years ago, Mr. Dixon commenced the manufacture of bar iron near St. Rollox, but, after some time, he abandoned the manufactory. It is now conducted on a great scale by Mr. Wilson, at Dundyvon, and by Mr. Dixon, at Glasgow, and perhaps by other iron-masters. The heat raised in the puddling furnace is much greater than it was in Staffordshire, when I witnessed the process there about twenty-five years ago. There is an interesting manufactory of steel, at Holytown, not far from Airdrie, where melting and casting steel may be seen: the heat necessary for this process is greater than for any other. It is curious, that the clay in the neighbourhood answers perfectly for making crucibles for cast steel: but it does not answer so well as Stourbridge clay, for making glasshouse pots. On analyzing the

two clays, we found that the Garnkirk contained much more alumina and less silica, than the Stourbridge; showing that glass in fusion acts more powerfully on alumina than on silica.

2. Another manufacture of importance, and which is indebted to Glasgow for the state of perfection which it has reached, is that of *sulphuric acid*. It was begun by Dr. Roebuck, at Prestonpans, about the year 1763, but it is not more than twenty years since his manufactory was abandoned. The sulphuric acid works, at St. Rollox, on the banks of the Monkland canal, were begun about forty-five years ago. They were at first upon a very small scale, though now probably are the largest of the kind in Europe. Dr. Roebuck's method was to mix together sulphur and saltpetre, and after setting the mixture on fire to introduce it into a leaden vessel or chamber, at the bottom of which there was a quantity of water. This method was not economical. A portion of the sulphur would unite with the potash of the saltpetre, and form with it a sulphuret, and probably a portion of the sulphuric acid formed, would also unite to the potash and form a sulphate. When Messrs. Knox, Tennent, and Macintosh, established their works at St. Rollox, they separated the sulphur from the saltpetre; the sulphur was burnt over a stove; and an iron cup containing the requisite quantity of saltpetre, mixed with the requisite quantity of sulphuric acid, was placed over the burning sulphur. By this contrivance the sulphur was completely converted into sulphurous acid, and the whole of the nitric acid carried along with it into the leaden chambers. The size of the leaden chambers was gradually increased, and the substitution of steam for the water formerly placed at the bottom of the chambers, was a vast improvement. The acid which collects at the bottom of the chambers has now a specific gravity of 1.75, or it is a compound of one atom anhydrous acid, and two atoms water. This acid is concentrated by heating it in a platinum still, till the second atom of water is driven off. When this manufacture is at full work, the quantity of sulphuric acid made in it exceeds 300,000lb. avoirdupois per week. When I first began to purchase sulphuric acid, about forty-five years ago, it cost 8*d*. per pound; the present price is under a penny a pound.

3. One of the great purposes to which sulphuric acid is applied at St. Rollox is, the manufacture of *bleaching powder, or chlorite of lime*, as it is now called. When the mode of bleaching by chlorine was introduced into Great Britain, by Mr. Watt, in 1787, the very offensive smell and deleterious effects of that gas upon the workmen, was a formidable objection to its use. Various methods were tried to remove this objection. It was found, that if potash or soda was dissolved in the water before it was impregnated with the chlorine gas, the disagreeable smell was destroyed; but, unfortunately, this addition destroyed at the same time the bleaching power of the gas. At last Messrs. Knox, Tennent, and Macintosh discovered, that if lime were mixed with the water before it was mixed with the gas, the disagreeable smell was obviated, while the bleaching power still remained uninjured. They took out a patent for this discovery; but it was infringed upon by the Lancashire bleachers, a lawsuit was the consequence, and the patent was destroyed. It was then that Mr. Macintosh tried, whether chlorine would not be absorbed by slacked lime. The trial succeeded: a compound was formed, which readily dissolved in water, and the solution of which possessed great bleaching power; a patent was taken out for the manufacture of this dry powder, which the patentees distinguished by the name of bleaching powder. This patent was not infringed; the sale of it was at first small, and it was overlooked by the bleachers. The consequence was, that the patentees had leisure to perfect their method of preparing it, and to become able to sell it at so low a price, that it gradually superseded all the old methods of bleaching by chlorine. The process may be seen at St. Rollox in great perfection, and on a very large scale. The requisite mixture of common salt, binoxide of manganese and sulphuric acid, is put into a leaden still, and the chlorine evolved passes through leaden tubes into air-tight stone chambers, the bottoms of which are covered with a stratum of slacked lime several inches thick. The lime absorbs the gas as it passes into the chamber, and the process is continued till the absorption is reckoned sufficient. Bleaching powder, supposing it pure, is a compound of

1. Chloride of calcium	7
2. Chlorite of lime	10
3. Water	3.375
	20.375

Half the lime loses its oxygen, and combines with chlorine, constituting chloride of calcium. The oxygen combines with chlorine, which, in the state of chlorous acid, combines with the other half of the lime, constituting chlorite of lime. Two atoms of the water were in the slacked lime. The third atom must have come along with the chlorine gas, or been absorbed from the atmosphere.

4. After the chlorine has been extricated, there remains in the still a semi-liquid mass, consisting partly of the impurities of the manganese, and partly of sulphate of soda and sulphate of manganese. If the manganese were pure binoxide, and only the quantity of salt and sulphuric acid necessary for the decomposition were used, the sulphate of manganese (abstracting the water) would weigh nine and a half, and the sulphate of soda nine. But in order to save the stills by producing the decomposition with little heat, twice as much sulphuric acid is used as is necessary, and this excess is afterwards saturated by means of common salt; so that the quantity of sulphate of soda in the residue is at least twice as great as that of the sulphate of manganese. To get rid of the sulphate of manganese, the residue from the stills is fused in a reverberatory furnace at a red heat; this drives off the sulphuric acid, and leaves the manganese in the state of sesquioxide. The whole is dissolved, and the insoluble manganese thrown away. The solution of sulphate of soda is evaporated to dryness, mixed with small coal, and fused again. This destroys the sulphuric acid, and converts the soda into sulphuret. This sulphuret being mixed with sawdust, &c., and exposed to an incipient red heat, the sulphur is driven off, and carbonate of soda remains, which is obtained in crystals by solution and crystallization, or in the state of *soda ash*, by a more rapid process. The theory of the last step of the process, in converting the sulphate of soda into carbonate, is not very obvious, and would require an experimental investigation to throw light on it. But my object at present is not to theorize, but to state facts.

5. Another chemical manufacture, which may be seen, is *alum-making*. There are two establishments, one at the Hurlet, about six miles south-west, by the Paisley canal; another at Campsie, about eight miles off, near Kirkintulloch, on the Great Canal, and near the foot of the Campsie Hills. The alum is made from the *shale*, which exists in great abundance in the exhausted coal beds. This shale is a clay mixed with some coal, and with that variety of iron pyrites, which undergoes decomposition, and is converted into sulphate of iron, by exposure to the air. The sulphate of iron, thus formed, acts slowly on the clay, and in process of time converts it into sulphate of alumina. The alum-maker washes this altered shale, and obtains a solution of sulphate of iron and sulphate of alumina. When sufficiently concentrated and cooled, the liquor yields an abundant crop of sulphate of iron, which is removed, dried, and sold at a cheap rate. The sulphate of alumina does not crystallize till it is mixed with sulphate of potash or sulphate of ammonia; because alum is a double salt, composed of three atoms of sulphate of alumina and one atom of sulphate of potash, or sulphate of ammonia. Formerly nothing but chloride of potassium, bought from the soap-makers, was used. But of late years (at least at Hurlet), sulphate of ammonia, from the liquor obtained during the preparation of gas, has been employed. In general, the alum made at Hurlet contains both potash and ammonia; but the manufacturer can supply it free from potash. Such alum is convenient to chemists, because when it is heated to redness everything is driven off except pure alumina. At Hurlet and at Campsie both, the mode of concentrating the liquid by a current of heated air passing over its surface, deserves attention.

6. At Campsie alum works may be seen another interesting chemical manufacture, the fabrication of prussiate of potash, a beautiful well known yellow salt, which crystallizes in truncated octahedrons. It was here that the manufacture of this salt, on a great scale, first began. Before that time, it was only prepared in laboratories for scientific purposes, and sold at a high price. Mr. Macintosh introduced it to the calico-printers, who use it extensively, to produce very beautiful blues and greens. It is prepared by burning the hoofs and horns of cattle in iron pots, along with a quantity of potash. The hoofs and horns of a hundred head of cattle are consumed every day in the works. For some time no iron was added, the requisite quantity for forming the salt being corroded from the pots during the combustion. But the last time that I visited the works, I found that iron was mixed with the hoofs, &c., during the combustion. The residue after this combustion is lixiviated with water, and when the solution is sufficiently concentrated, the prussiate of potash crystallizes. Connected with this manufactory of prussiate of potash is another of Prussian blue. It is made by mixing sulphate of iron, alum, and prussiate of potash, and precipitating the whole by an alkali. The precipitate is at first light blue. But it is washed with new portions of water every day, for several weeks. At every washing the colour deepens, and when it has acquired the requisite shade, the Prussian blue is allowed to subside, the water is drawn off, and the powder allowed to dry. The colour varies according to the proportion of alum employed, and it has the finest colour of all, with the coppery lustre which is so much admired, when no alumina whatever is mixed in it.

7. Another beautiful chemical product may be seen at Shawfield, near Rutherglen, about two miles from Glasgow, in the manufactory of Mr. White. I mean *bichromate of potash*, a salt very much used by calico-printers, and forming the finest and most indelible yellows, oranges, and greens. Its introduction constituted quite an era in calico-printing. This salt was originally made by heating chromiron ore with saltpetre, dissolving out the chromate of potash, and adding the requisite quantity of nitric acid to deprive the chromic acid of half its potash. When this process began, the salt was sold at a guinea an ounce. But now, when the price is as low as two shillings a pound, it is necessary to prepare it by a cheaper method. It has been found that common potash of commerce may be substituted for saltpetre; and I believe the manufacturers now contrive to form the bichromate at once, without requiring the use of an acid, which would nearly double the expense. I believe all the bichromate used by the calico-printers is made here and in Liverpool. In the same manufactory may be seen a beautiful product; I mean tartaric acid, which is used by the calico-printers to a large amount, chiefly to disengage the chlorous acid from bleaching powder, and enable it to destroy the colour on particular parts of the cloth, either that these parts may remain white, or that some other colour may be superadded. Tartaric acid is obtained from cream of tartar, by throwing down the tartaric acid by means of lime, and afterwards decomposing the tartrate of lime by means of sulphuric acid, and crystallizing the tartaric. At the same manufactory may be seen a pretty and simple process, by which the carbonate of soda is converted into the sesquicarbonate. By simply exposing it dry and in powder, in an atmosphere of carbonic acid gas, it absorbs the requisite quantity to be converted into sesquicarbonate. And this sesquicarbonate is chiefly used by the makers of soda water.

8. It is hardly proper to mention the manufactory of acetic acid from wood, which has been carried on for many years by Mr. Turnbull, because the first part of the process is, I believe, carried on at a distance, for the sake of the wood—I mean, the distillation of the wood. To free the acetic acid from the tar, which destroys its flavour and taste, the acid is combined with lime, and the acetate of lime exposed to a heat sufficiently high to char the foreign bodies with which it is impregnated, the acetic acid being capable of resisting a higher temperature without decomposition than most compound vegetable bodies. The acetate of lime thus purified is decomposed by sulphuric acid, and the acetic acid obtained by distillation. By this process it may be obtained very strong. I have it composed of one atom acetic acid, and one atom water. When of this strength, it crystallizes in winter, but becomes liquid again in summer. In the same manufactory there is another liquid prepared, namely, *pyroxylic spirit*, now well known. A most interesting set of experiments on it

has been made by Dumas, who has distinguished its basis by the name of *methylene*, and has discovered various new compounds which it is capable of forming.

9. Another chemical manufacture of considerable importance, and which I believe to be peculiar to Glasgow, is *iodine*. A few years ago, there were no fewer than ten manufactories, in each of which it was made to a considerable extent; but as iodine is only used in medicine, the sale is necessarily limited, and I believe that most of these works are now abandoned. The process followed by all the makers was, I believe, the contrivance of Mr. Macintosh. Iodine is made from kelp, and it deserves attention, that those kinds of kelp that contain most potash contain, at the same time, the most iodine. The kelp is lixiviated, and all the salts that can be extracted from the solution by evaporation are separated. The mother water remaining is now mixed with an excess of sulphuric acid. A great quantity of sulphuretted hydrogen is evolved, the bad effects of which on the workmen are obviated by setting it on fire, and allowing it to burn as it is extracted from the liquid. To the liquid thus freed from sulphuretted hydrogen and from muriatic acid, a quantity of binoxide of manganese, equal in weight to the sulphuric acid employed, is added. The whole is put into a leaden still, and heated to a temperature which must not exceed 190° or 200° at most. The iodine passes into the receiver, which consists of a series of spherical glasses, having two mouths opposite to each other, and inserted the one into the other.

10. It may seem superfluous to mention *soap*, because it is a manufacture universally known: but soap of a very superior quality is made in Glasgow. The number of soap works amounts to seven, and one of these, that at St. Rollox, is the third, if not the second, in point of extent, in Great Britain. The ingredients of soap are soda, tallow, and rosin, and sometimes palm oil. Two kinds only of hard soap are made here, namely, *yellow* and *white*. The yellow soap is made by boiling 9.75 cwt. of tallow, 3.25 cwt. of rosin, 4 cwt. of soda ash, equivalent to 2 cwt. soda, mixed with the requisite quantity of water. The white by boiling 13 cwt. of tallow, 4 cwt. of soda ash in the same manner. Tallow, which is a compound of two oily acids and glycerine, undergoes decomposition, and the soda combines with the acid and forms soap. When the combination is complete, a quantity of common salt is put into the hot liquor. It dissolves in the water, and the soap separates, and swims on the top. It is now allowed to cool to 150° at an average, and then taken out in a liquid state, and poured into frames, where it is allowed to become solid, and then cut into the usual parallelopipeds, or wedges, as they are called. It is customary, during the *cleansing* of the soap, as the pouring it into the frame is called, to mix it with a quantity of caustic soda ley. The soap made in Glasgow is usually a compound of—

1 atom oily acid	53	or per cent.	74.6
2 atoms soda........	8	,,	11.2
9 atoms water	10.125	,,	14.2
	71.125		

White soap is cleansed at the average temperature of 181°. Its constitution is precisely the same as that of yellow soap.

11. Bleaching of cotton cloth is carried on here to a great extent. It consists of four processes:—1st, The goods are boiled with lime, at a temperature above the boiling point of water. The process is curious, and deserves to be seen. 2nd, The cloth is steeped in a solution of bleaching powder. 3rd, It is boiled with caustic soda or potash. 4th, It is steeped in water acidulated with sulphuric acid.

12. Turkey red dyeing has been practised here for almost half a century.

13. I need hardly mention *calico printing*, which is carried on here to a great extent; *glass-making*, which is carried on here or on the Clyde in all its branches; *starch-making*, of which there is only one manufactory. The manufacture of the dye stuff called cudbear, employed in dyeing red, has long been carried on here; so has the distillation of spirits, and the manufacture of ether.

'Additional Observations on the Voltaic Decomposition of Alcohol,' by Arthur Connell, Esq.

The author showed, a few years ago, that under powerful voltaic agency, the water entering into the constitution of absolute alcohol was resolved into its elements, hydrogen being evolved at the negative pole, and oxygen going to the positive, where it produces secondary effects of oxidation (Transactions of the Royal Society of Edinburgh, vol. xiii.); and that the galvanic agency was greatly increased by dissolving minute quantities of potash in the alcohol, so small a quantity as $\frac{1}{10000}$th part having a marked effect, by increasing the conducting power of the liquid. As it had been objected that the water of the hydrate of potash employed might contribute to the result, the author has since employed potassium instead of hydrate of potash, with precisely the same effects. It is known, that when potassium is dissolved by alcohol, it is oxidated with evolution of hydrogen, so that in this way we produce the same consequences as if we added anhydrous potash. By adding small quantities of potassium, such as $\frac{1}{200}$ or $\frac{1}{300}$, to absolute alcohol (sp. gr. 791.8, at 66° F.), and then submitting the liquid to voltaic action, hydrogen was given off at the negative pole; and when the effect ceased, it was renewed by re-charging the battery, and again adding a similar small quantity of potassium; and the usual secondary effects of oxidation were produced at the positive pole. In instituting a comparison between the quantity of hydrogen thus given off, and that evolved by the same electric current from acidulated water, it is necessary that a powerful current should be employed, and a somewhat larger quantity of potassium dissolved, because otherwise, from the inferior conducting power of the liquid, and from a little of the hydrogen entering into the constitution of the secondary products, the quantity of hydrogen evolved from the alcohol is somewhat less than that from the acidulated water; and the comparison is best instituted during the early stages of the action, because the conducting power of the liquid diminishes as the potash gets saturated by the secondary products, and the electric energy declines also. The author still regards these experiments as affording the only *direct* proof which we yet have of the existence of water as such in absolute alcohol.

Prof. Graham had no doubt of the accuracy of the experimental results, but thought that the hydrogen might come from the alcohol itself, without the intervention of water.—Mr. Connell conceived it to be impossible, on electro-chemical grounds, that hydrogen should go to one pole, and the other constituents of alcohol to the other, there being no evidence of any other *one* substance at the positive pole which could have been in combination with hydrogen, as an electrolytic combination. On the contrary, the products at the positive were *various*, such as resinous matter, and carbonic acid uniting with potash, when potash was in solution, and all were products of *oxidation*, similar to those obtained by other methods of oxidating alcohol; and oxygen itself could, by particular arrangement, formerly detailed, be made *visible* in a state of evolution at the positive pole.—Dr. Thomson referred to Dr. Ritchie's statement, several years ago, that olefiant gas was given off at the negative pole; and Mr. Pearsall stated that he had been present at Dr. Ritchie's experiments.—Mr. Connell answered, that he had examined the gas carefully by chlorine and by the electric spark, and found it not to be olefiant gas, but hydrogen; and he conceived that the idea that it was olefiant gas had arisen from the presence of vapour of alcohol and of common air derived from the alcohol, which sometimes causes a residuum after detonation with oxygen.

'Process for preparing Hydrobromic and Hydriodic Acids,' by Dr. R. W. Glover, of Newcastle.—Dr. Glover having observed that the solid bromide and iodide of barium are decomposed by sulphuric acid, with the evolution of hydrobromic and hydriodic acids, without bromine or iodine being set free, proposed the employment of these salts of barium as very convenient sources of the above-named hydracids in atomic proportions.

'On the compound, or radical called Kakodyl,' by Professor Bunsen, of Marburg.

The object of this paper was to describe a new radical resembling alcohol, in which arsenic replaced the oxygen of that compound. This radical enters into numerous combinations, forming, with oxygen, a peculiar acid called kakodylic acid. The oxide of kakodyl has so great an affinity for oxygen, that when exposed to the air it immediately inflames. The bodies produced by the combustion are arsenious acid, carbonic acid, and water. By the further oxidation of the oxide of kakodyl, kakodylic acid is produced. The sulphuret of kakodyl is similar in composition to the oxide, and participates in many of its properties. The telluret, selenuret, iodide and bromide of kakodyl were also examined. The danger attending these experiments is very great, and the poisonous effects produced by the inhalation of the vapour were described as dreadful. Kakodyl is produced from the liquor of cadet, and is extremely interesting as being a link connecting organic and inorganic chemistry. Professor Bunsen is engaged in further experiments on this subject, and has already obtained many new combinations.

'On a new Method of Preparing Morphia and its Salts,' by Dr. Mohr, of Coblentz.

The plan adopted by the author for separating morphia from narcotin and all other heterogeneous substances, consists in dissolving it in an excess of caustic lime, and precipitating it by muriate of ammonia. This method of precipitation is, in principle, very similar to the precipitation of alumina, from a solution in caustic potash. The process is as follows: the opium is boiled in water, in which it readily dissolves; the decoction is strained through a linen cloth and the dregs are pressed; this operation of boiling and straining is repeated twice on the same quantity of opium, and the solution of the whole concentrated until its weight is four times that of the opium employed. The concentrated solution is, while still warm, mixed with milk of lime, prepared with a quantity of dry lime equal to the fourth part of the weight of the opium. The mixture is heated till it boils, and is filtered through linen while hot. The filtered liquor has a light brown yellow colour. While still hot it is mixed with pulverized sal ammoniac in excess; the lime is saturated with muriatic acid, ammonia is set free, and the morphia is precipitated. When the solution is greatly concentrated, the precipitation is instantaneous, and is almost equal in volume to half the solution. When, however, the solution is less concentrated, there is at first no precipitation, but as the liquor cools open needles appear, and at a certain point a large mass of precipitate is suddenly formed. The peculiarity of this process is, that it affords a well crystallized and fine product of morphia, without requiring the use of alcohol. This is owing to the circumstance that the ammonia is not added in a free state, but is generated in immediate contact with the substance to be acted upon. The morphia is nearly colourless; by dissolving it in muriatic acid, and subjecting the solution to crystallization, we obtain muriate of morphia, in perfectly white crystals quite pure. The milk of lime, it is to be observed, must not be added to a boiling hot solution of the crude opium, otherwise the precipitate adheres to the sides of the vessel, and does not afterwards re-dissolve perfectly. The liquor containing the morphia should either be cold or only luke warm when the milk of lime is added to it. If it is boiling hot it must be added to the milk of lime, and not *vice versâ*.

Dr. Gregory observed, that this was an excellent method of preparing morphia on the small scale and for class-room experiments, and complimented the author on his knowledge of the English language, in which the paper was written.

The last paper read was by Mr. Sturgeon 'On a peculiar Class of Voltaic Phenomena.'—The author directed attention to some experiments published by himself in 1830, and to his theory respecting the electro-chemical action of the simplest metals on acid and other solutions. He stated that the fact of iron not precipitating copper from its sulphate and other solutions, as recently observed by Prof. Schönbein, was one of the many beautiful phenomena discovered by Keir, and published in the Phil. Trans. for 1790.

SATURDAY.

'On a New Method of Photogenic Drawing,' by Dr. Schäfhaeutl.

After some observations on the comparatively low value of all drawings taken by means of the camera-obscura, in an artistical point of view, and on the principal points on which Mr. Talbot's and M. Daguerre's methods of fixing the drawings of the camera-obscura were founded, the author proceeded to describe his peculiar methods of producing photogenic drawings in Mr. Talbot's, that is, in a negative way; then, secondly, he described two new

methods of obtaining photographs in a *positive* way. His first method tended to obtain a paper of very great sensibility by a comparatively short process. He recommended Penny's improved patent metallic paper, and spreading a concentrated solution of the nitrate of silver (140 grains to 2¼ drachms of fused nitrate to 6 fluid drachms of distilled water), by merely drawing the paper over the surface of the solution contained in a large dish. In order to convert this nitrate of silver into a chloride, the author exposed it to the vapours of boiling muriatic acid. A coating of a chloride of silver, shining with a peculiar silky lustre, was by this method generated on the surface of the paper, without penetrating into its mass; and in order to give to this coating of chloride the highest degree of sensibility, it was dried, and then drawn over the surface of the solution of the nitrate of silver again. After having been dried, the paper was ready for use; and no repetition of this treatment was able to improve its sensitiveness. The author's process for fixing definitively the drawing was as follows:—He steeped the drawing from five to ten minutes in alcohol, and, after removing all superfluous moisture by means of blotting-paper, and drying it slightly before the fire, the paper thus prepared is finally drawn through diluted muriatic acid, mixed with a few drops of an acid nitrate of quicksilver, into the minutiæ of the preparation of which we cannot here enter. The addition of the nitrate of mercury requires great caution, and its proper action must be tried first on paper slips, upon which have been produced different tints and shadows by exposure to light; because, if added in too great a quantity, the lightest shades disappear entirely. The paper, after having been drawn through the above-mentioned solution, is washed well in water, and then dried in a degree approaching to about 158° Fahr., or, in fact, till the white places of the paper assume a very slight tinge of yellow. The appearance of this tint indicates that the drawing is fixed permanently. The author's way for reversing the drawing is, in the principal points, the same as that suggested by Mr. Fox Talbot. In order to obtain a photogenic drawing in a direct or positive way, the author uses his above-mentioned paper, allows it to darken in a bright sunlight, and macerates it for at least half an hour in a liquid, which is prepared by mixing *one part* of the already described acid solution of nitrate of mercury with from nine to ten parts of alcohol. A bright lemon-yellow precipitate, of basic hyponitrate of the protoxide of quicksilver falls, and the clear liquor is preserved for use. The macerated paper is removed from the alcoholic solution, and quickly drawn over the surface of diluted hydrochloric acid (1 part strong acid to 7 or 10 of water), then quickly washed in water, and slightly and carefully dried in a heat not exceeding 212° of Fahr. The paper is in this state ready for being bleached by the rays of the sun; and in order to fix the obtained drawing, nothing more is required than to steep the paper a few minutes in alcohol, which dissolves the free bichloride of mercury. The maceration must not be continued too long, as in that case the paper begins to darken again. The author's second method of producing positive photogenic drawings was by using metallic plates, and covering them with a layer of hydruret of carbon, prepared by dissolving pitch in alcohol, and collecting the residuum on a filter. This, when well washed, is spread as equally as possible over a heated even metallic plate of copper. The plate is then carbonized in a closed box of cast iron, and, after cooling, passed betwixt two polished steel rollers, resembling a common copper-plate printing-press. The plate, after this process, is dipped into the above-mentioned solution of the nitrate of silver, and instantly exposed to the action of the camera. The silver is, by the action of the rays of the sun, reduced into a perfect metallic state, and the lights expressed by the different density of the milk-white deadened silver, the shadows by the black carbonized plate. In a few seconds, the picture is finished; and the plate is so sensitive, that the reduction of the silver begins even by the light of a candle. For fixing the image, nothing else is required, except dipping the plate in alcohol mixed with a small quantity of the hyposulphite of soda, or of pure ammonia.

Prof. Graham then gave an Abstract of Prof. Liebig's New Chemical Views relative to Agriculture and Physiology, as contained in his Report on the applications of Organic Chemistry in Agriculture and Physiology.

The primary source, it is observed, whence man and animals derive the means of their growth and support, is the vegetable kingdom. Plants, on the other hand, find new nutritive material *only in inorganic substances*. It is obvious, that the last proposition, if true, will afford a firm basis on which to build the superstructure of the chemical physiology of plants. A different opinion has hitherto prevailed. The fertility of every soil has been generally supposed by physiologists to depend on the presence in it of a peculiar substance, to which they have given the name of *humus*. This substance, believed to be the principal nutriment of plants, and to be extracted by them from the soil in which they grow, is itself the product of the decay of other plants. The obvious difference in the growth of plants, according to the known abundance or scarcity of *humus*, was considered an incontestible proof of the correctness of this opinion. Yet Liebig adduces the most conclusive proofs that *humus*, in the form in which it exists in the soil, does not yield the smallest nourishment to plants. 1st. The humus or humic acid of chemists, (obtained by means of precipitating an alkaline decoction of mould or peat by means of acids,) although soluble, when newly precipitated, is known to become completely insoluble when dried in the air, or when exposed in the moist state to the freezing temperature. This is also demonstrated by treating a portion of good mould with cold water. The fluid remains colourless, and is found to have dissolved less than 100,000th part of its weight of organic matters, and to contain merely the salts which are present in rain water. Decayed wood also yields only slight traces of soluble materials. It has, indeed, been admitted by physiologists, that humic acid, in its unaltered condition, cannot serve for the nourishment of plants; and hence they have assumed, that the lime or the different alkalies found in the ashes of vegetables render soluble the humic acid, and fit it for the process of assimilation. But even supposing the humic acid to be absorbed by plants, in the form of that salt, which contains the largest proportion of humic acid, namely, the humate of lime, Liebig shows, from the known quantity of the alkaline bases contained in the ashes of plants, in relation to the carbon they contain, that not so much as 1-30th of the carbon of fir wood, nor so much as 1-20th of the carbon of wheat straw, could be derived from humus in this way. 2nd. Humate of lime requires 2,500 parts of water for solution. Now, supposing all the rain water which falls upon a field to become saturated with humate of lime, and to be absorbed by the plants growing upon it, then the quantity of humate of lime, which the plants thus nourished could obtain, might be calculated. But it proves to be quite insufficient to account for the carbon contained in the corn or in beet-root grown upon the land. 3rd. A certain quantity of carbon is taken every year from a forest or meadow, in the form of wood or hay, and, in spite of this, the quantity of carbon in the soil augments —it becomes richer in humus.

The carbon of plants must therefore be derived from other sources; and as the soil does not yield it, it can only be extracted from the atmosphere. Physiologists, in attempting to explain the origin of carbon in plants, overlook the circumstance that the question is intimately connected with that of the origin of humus. It is universally admitted that humus arises from the decay of plants. No primitive humus, therefore, can have existed, for plants must have preceded the humus. That plants derive the *carbon* exclusively from the decomposition of carbonic acid, chiefly and often entirely supplied by the atmosphere, is the conclusion to which Liebig arrives. They restore oxygen at the same time to the atmosphere, agreeably to the observation of Priestley, De Saussure, and others. The decomposition of carbonic acid, it is true, is arrested by the absence of light, and then plants appear to produce and evolve carbonic acid. But then, namely, at night, according to Liebig, a true chemical process commences, in consequence of the action of the oxygen in the air upon the organic substances composing the leaves, blossoms, and fruit. This process is not at all connected with the life of the vegetable, because it goes on in a dead plant exactly as in a living one. The formation of acids is effected during the night by a true process of oxidation; the volatile oils also change into resins by the absorption of oxygen. The carbonic acid, which has been absorbed by the leaves and by the roots, together with water, ceases to be decomposed on the departure of day-light: it is dissolved in the juices, which pervade all parts of the plant, and escapes through the leaves by evaporation. Plants which live in a soil containing humus, exhale much more carbonic acid during the night than those which grow in dry situations—the decomposition of the humus in the soil affording additional carbonic acid to the roots of the former. The opinion is not new that the carbonic acid of the air serves for the nutriment of plants, and that the carbon is assimilated by them, having been advocated by the ablest natural philosophers, but has not been properly appreciated by naturalists—partly, Liebig believes, from their imperfect acquaintance with chemistry, and partly from certain objectionable experiments which were instituted by them in order to decide the point. That the developement of the plants growing from seeds sown in pure Carrara marble and in sulphur did not advance far, although sprinkled with carbonic acid water, is not to be wondered at, seeing that many conditions are necessary for the life of plants; those of each genus requiring special conditions, and should but one of these be wanting, although all the rest be supplied, the plants will not be brought to maturity. The sources of the nitrogen and earthy bodies, which all plants contain, were withheld in these experiments. The mere observation of a wood or a meadow, Liebig considers infinitely better adapted to decide the question, than all the trivial experiments under a glass globe. Having shown that the carbon of plants is derived from the atmosphere, Liebig next inquires what power is really exerted on vegetation by the humus of the soil.

Woody fibre, in a state of decay, is the substance called *humus*. This body possesses the property to convert oxygen into carbonic acid. A substance then remains, *mould*, which is the product of the complete decay of woody fibre. It constitutes the principal part of all the strata of brown coal and peat. *Humus is a continued source of carbonic acid*, which it emits very slowly. Such is the chief function which Liebig ascribes to it in vegetation. There is no reason to believe that humus, if absorbed by plants, would not be assimilated, more than sugar, starch, and gum, which humus considerably resembles, and which, when absorbed by the roots of plants, are not assimilated, but again discharged by the roots, or excreted by the leaves. Cultivation is useful, as tilling and loosening the soil allows access of air to the humus, and thus gives rise to the formation of carbonic acid. When a plant is quite matured, and when the leaves, the organs by which it obtains food from the atmosphere, are formed, the carbonic acid of the soil is no further required.

The Assimilation of Hydrogen.—The solid part of plants (woody fibre) contains carbon and the constituents of water ($C + H, O$), or the elements of carbonic acid, together with a certain quantity of hydrogen. The wood may be formed from a combination of the carbon of the carbonic acid with the elements of water, under the influence of solar light, the oxygen of the carbonic acid being at the same time evolved. Or,—and this view Liebig thinks more probable,—plants, under the same circumstances, may decompose water, the hydrogen of which is assimilated, along with carbonic acid. The oxygen disengaged from plants will therefore come from water. But the volume of this gas set free would be the same, whether derived from the decomposition of carbonic acid or of water. A part, or the whole of the oxygen besides contained in the carbonic acid, must also be set free, in the formation of such a substance as an essential oil, which contains only a small portion of oxygen, or no oxygen, as a constituent.

On the Origin and Assimilation of Nitrogen.—Prof. Liebig established the fact that the third of the organic elements is uniformly derived by plants from *ammonia*. Like water, that body admits of numerous transformations in contact with other bodies. He has demonstrated the existence of ammonia in the atmosphere, by original experiments, having obtained it in a minute but sensible quantity from rain-water collected at a distance from all habitations. The diffusion of this substance in the mineral kingdom is

also evinced by the existence of calcareous nitre soils and rocks, there being good reason to consider nitric acid as a product of the transformation of the former. A salt of ammonia also sublimes with the boracic acid, condensed in the hot boracic lagoons of Tuscany. Ammonia is also observable in the state of a salt in the juices of plants. The juices of the maple-tree and of beet-root are found, in the process of preparing sugar from them, to contain ammonia in considerable quantities. Putrified urine contains nitrogen in the forms of carbonate, phosphate, and lactate of ammonia, and in no other form. It is employed in Flanders as a manure with the best results. Animal manure, Liebig believes to act only by the formation of ammonia. The latter substance must also form the red and blue colouring matter of flowers.—The evident influence of *gypsum* upon the growth of grasses, the striking fertility and luxuriance of a meadow upon which it is strewed, depends only upon its fixing in the soil the ammonia of the atmosphere, which would otherwise be volatilized with the water which evaporates. The ammonia, which is in the state of carbonate, is then decomposed, as in the manufacture of sal ammoniac, and the sulphate of ammonia produced. The advantage of manuring fields with *burned clay* and the fertility of ferruginous soils, which have been considered as facts so incomprehensible, are explained in an equally simple manner. The true cause is this:—The oxides of iron and alumina are distinguished from all other metallic oxides by their power of forming solid compounds with ammonia. The ammonia is separated from them by every shower of rain, and conveyed in solution to the soil. *Powdered charcoal* surpasses all other substances in the power to absorb ammonia and other gases, and has been observed to promote vegetation in an extraordinary degree. Decaying wood possesses the same property. Humus, therefore, is not only a slow and constant source of carbonic acid, but is also a means by which the necessary nitrogen is conveyed to plants. Nitrogen, Liebig observes, is found in lichens, which grow on basaltic rocks. Our fields produce more of it than we have given them as manure, and it exists in all kinds of soils and minerals which were never in contact with organic substances. The nitrogen in these cases could only have been attracted from the atmosphere. Carbonic acid, water, and ammonia, contain the elements necessary for the support of animals and vegetables. The same substances (he adds) are the ultimate products of the chemical processes of decay and putrefaction. All the innumerable products of vitality resume, after death, the original form from which they sprung. And thus death—the complete dissolution of an existing generation—becomes the source of life for a new one.

But another class of substances is also necessary for the life of vegetables.

The Inorganic Constitution of Plants.—These substances are found in the ashes left after the incineration of plants, although in a changed condition. Many of these inorganic constituents vary according to the soil in which the plants grow, but a certain number of them are indispensable to their developement. Phosphate of magnesia in combination with ammonia is an invariable constituent of the seeds of all kinds of grasses. Plants also contain various organic acids, all of which are in combination with bases, such as potash, soda, lime, or magnesia. Of the different alkaline bases found in plants, Liebig finds reason to conclude, that any one may be substituted for another, the action of all being the same. But the number of equivalents of these various bases remains the same. The analyses of Berthier and Saussure show that the nature of a soil exercises a decided influence on the quantity of different metallic oxides contained in the plants which grow upon it: that magnesia, for example, was contained in the ashes of a pine-tree, grown at Mont Breven, while it was absent from the ashes of a tree of the same species from Mont La Salle, and that even the proportion of lime and potash was very different. But although the composition of the ashes of these pine-trees was so very different, they contained an equal number of equivalents of metallic oxides; or, what the same thing, the quantity of oxygen contained in all the bases was in both cases the same—being expressed by the number 9.01 in one case, and by 8.95 in another, a coincidence which had escaped the notice of the analyst himself. It is certain that particular acids exist in different vegetables, and are necessary to their life; some alkaline base is also indispensable, in order to enter into combination with the acids, which are always found in the state of salts. The perfect developement of a plant is therefore dependent on the presence of alkalies or alkaline earths, and its growth is arrested when these substances are totally wanting, and impeded when they are only deficient. Hence it is that of two kinds of tree, the wood of which contains unequal quantities of alkaline bases, one may grow luxuriantly in several soils, upon which the other can scarcely vegetate. Thus 10,000 parts of oak-wood yield 250 parts of ashes, and the same quantity of fir-wood only 83 parts. Hence, firs and pines find a sufficient quantity of alkalies in granitic and barren sandy soils, in which oaks will not grow. Liebig supplies various additional illustrations of the influence of the alkaline metallic oxides on vegetation, amply sufficient to place beyond controversy these conclusions, so important to agriculture and to the cultivation of forests. One of these Prof. Graham quoted: a harvest of grain is obtained every thirty or forty years from the soil of the Luneburg heath, by strewing it with the ashes of the heath plants which grow on it. These plants, during the long period mentioned, collect the potash and soda from the decomposing minerals of the soil, which are conveyed to them by rain water; and it is by means of these alkalies that oats, barley, and rye, to which they are indispensable, are enabled to grow on this sandy heath. The supposition of alkalies, metallic oxides, or inorganic matter in general being produced by plants, is entirely refuted by such well authenticated facts. It is thought very remarkable, that those plants of the grass tribe, the seeds of which furnish food for man, follow him like the domestic animals. But none of our corn plants can bear perfect seeds, that is, seeds yielding flour, without a large supply of phosphate of magnesia and ammonia, substances which they require for their maturity. Hence these plants grow only in a soil where these three constituents are found combined, and no soil is richer in them than those where men and animals dwell together. Prof. Liebig then applies these great fundamental principles, in this report, to the *art of culture*, under the following heads: use of humus—nutrition and growth of plants—necessity of azotized substances—influence of the food on the produce—composition of soils—the fertility of soils—fallow. Then, under the head of interchange (rotation) of crops and manure, he discusses the varieties and applications of particular manures, composition of animal manures, the essential elements of manure, bone manure, manure supplies nitrogen, mode of applying urine, value of human excrements. In the second part of his report, Prof. Liebig discusses the chemical processes of fermentation, decay, and putrefaction, under the heads of chemical transformations—eremacausis or decay—vinous fermentation—wine and beer—decay of woody fibre—on the mouldering of bodies—and on poisons, contagious matter, and miasms. The novel theoretical views with which this department of the work abounds, are remarkable, equally with those of the preceding part, for their profundity and for their valuable applications. The subjects discussed, however, are numerous, and of such a nature that great injustice would necessarily be done to them in a short and hasty abstract.

Dr. Gregory stated, that having studied Prof. Liebig's work, it appeared to him in the highest degree important, as being the first attempt to apply the newly-created science of Organic Chemistry to Agriculture; that, in his opinion, from this day might be dated a new era in that art, from the principles established, with such profound sagacity, by Prof. Liebig. He was also of opinion, that the British Association had just reason to be proud of such a work, as originating in their recommendation.

Dr. Playfair 'On a New Fat Acid.'—Dr. Playfair had examined some of the vegetable fats, for the purpose of ascertaining whether the margaric acid contained in them possessed a constant composition. He remarked that the acid in the butter of nutmegs was peculiar, and had not formerly been examined. Pelouze and Bondet have stated in the *Annales de Chimie*, that it is margaric acid. Dr. Playfair considered that the radicals of serecic and œnanthic acid were similar; in the former, however, one equivalent of hydrogen is replaced by one equivalent of oxygen. It is a beautiful white crystalline compound melting at 49° C., and is soluble both in alcohol and ether. The combination of the acid with oxide of glyceril, exists in the butter; it unites with metallic oxides and forms salts: these were described, but the results are not susceptible of analysis, as they were principally numerical. The formula of the acid is $C_{28}\ H_{54}\ O_3$.

Dr. Ettling 'On the Identity of Spiroilous and Saliculous Acid.'—The oil discovered by M. Pagenstecher, and obtained by the distillation of the *spiræa ulmaria*, has already attracted considerable attention. Dr. Ettling had analyzed it previously to the appearance of M. Piria's valuable paper on Salicyl. The oil decomposes into two oils on keeping, one of which is specifically lighter, the other heavier than water. Dr. Ettling discovered that the latter possessed the same composition as hydrated benzoic acid. The action of ammonia on the oil gives rise to some new interesting compounds. In order to obtain these compounds it is indifferent whether saliculous or spiroilous acid be employed. The final product of the action of ammonia upon these, is the amide of salicyl (salicylamide). This body evidently belongs to the class of amides, for it does not evolve ammonia, on the addition either of potash or of acids. The cause of its formation is as follows: three atoms of saliculous acid unite with three atoms of ammonia, and form saliculite of ammonia, whilst three of hydrogen and oxygen combine together and form water. This salicylamide unites with copper, iron, and lead, forming compounds.

Professor Liebig 'On Poisons, Contagions, and Miasms.'—Dr. Playfair stated that he had prepared, at the request of the author, a statement of Prof. Liebig's new views on the subject of poisons. Poisons might be divided into two classes, those belonging to the inorganic and organic kingdoms. Many substances were called inorganic poisons which had in reality no claim to be considered as such. Sulphuric, nitric, and muriatic acid, when brought into contact with the animal economy, merely destroyed the continuity of the organs, and might be compared, in their *modus operandi*, to the action of a heated iron, or a sharp knife. But there are others—and these are the true inorganic poisons—which entered into combination with the substance of the organs without effecting any visible lesion of them. Thus it is known, that when arsenious acid or corrosive sublimate is added to a solution of muscular fibre, cellular tissue, or fibrin, these enter into combination with them, and become insoluble; when they are introduced into the animal organism the same circumstance must happen. But the bodies formed by the union of such poisons with animal substances are incapable of putrefaction; they are incapable, therefore, of effecting and suffering changes; in other words, organic life is destroyed. The high atomic weight of animal substances explains the cause of such small quantities being requisite for producing deadly effects. After stating several chemical details on this subject, it was shown that to unite with 100 grains of fibrin, as it exists in the human body, (in which it is combined with 30,000 parts of water) only 3¾ grains of arsenious acid are necessary, or 5 grains of corrosive sublimate. The second class of poisons were those belonging to the organic kingdom. For some such substances as brucia and strychnia, no data exist by which it can be determined to what cause their action may be assigned. But the morbid poisons, such as putrid animal and contagious matter, appear to owe their action to a peculiar agent, which exerts a much more general and powerful action than chemists are aware of. Thus, when oxide of silver is thrown into peroxide of hydrogen, the oxide is reduced, and metallic silver remains. Here there can be no affinity, for oxygen can have no affinity for oxygen. It is merely that a body in a state of motion or decomposition is capable of inducing upon or imparting its own state of motion or decomposition to any body with which it may be in contact. There is a disease frequently produced in Germany by using decayed sausages as an article of food. The symptoms attending the disease are remarkable, and distinctly indicate its cause. The patient afflicted with the disease becomes much emaciated, dries to a complete mummy, and finally dies. The muscular fibre and all parts similarly composed disappear. The cause of this evidently is, that the state of decomposition, in which

the component parts of the sausages are, is communicated to the constituents of the blood, and this state not being subdued by the vital principle, the disease proceeds until death ensues. It is remarkable that the carcases of the individuals, who have died in consequence of it, are not subject to putrefaction. The cause of the action of contagious matter is similar. It is merely a gaseous matter in the state of transformation, and capable of imparting the state of transposition, in which its atoms are, to the elements of the blood. It is capable of being reproduced in the blood just as yeast causes its own reproduction in fermenting *wort*. The causes of the action of yeast and of contagion were shown to be the same, and examples were produced in which similar reproductions take place in common chemical processes. There are two kinds of yeast used in the brewing of Bavarian beer. The fermentation caused by one is tumultuous; that produced by the other is tranquil. They, therefore, induce the peculiar state of transposition in which their atoms are upon the elements of the sugar. The same was shown to be the case with the vaccine virus of cow and human small-pox, of which, one produces a violent action upon the constituents of the blood, whilst the other causes a gentle action quite distinct from the former.

Prof. Hannay said he could not exactly coincide with the views proposed regarding the action of inorganic poisons, as he was convinced the cause of their virulence was owing to something further than mere combination with the animal membranes; nor could he coincide in the comparison brought forward by Dr. Playfair, that sulphuric and oxalic acids merely acted like a heated iron, by destroying the continuity of particular organs. He thought that through the course of the inquiry chemistry had been too much kept in view, and that medicine had not been sufficiently consulted. It was singular to see us brought back to the time of Hippocrates, who also had affirmed that contagious matter was a kind of yeast acting in the blood.—Dr. Playfair explained that Prof. Liebig expressly states in his report, that this subject cannot be completed without the co-operation of physiologists; that he had therefore merely brought forward the purely chemical part of the inquiry, and hoped thereby to draw the attention of physiologists to its further investigation. Hippocrates had certainly compared the action of yeast with that of contagious matter, and the comparison was so apt that it could scarcely be avoided; but the merit of Liebig's views is, that he has explained the action of yeast, and shown that it is owing to a peculiar agent which has hitherto escaped attention, but which plays a very important part in the phenomena of combination and decomposition.

FRIDAY.

Section C.—GEOLOGY AND PHYSICAL GEOGRAPHY.

Prof. Johnston submitted an account of the first part of his 'Report on Chemical Geology.' He referred to the combination of science requisite to promote geology. It had drawn upon the labour of the zoologist, the comparative anatomist, the botanist, the historian, the natural philosopher, and had now called in the assistance of the chemist. The Professor alluded to what had been done by the late Sir Humphry Davy and by the late Dr. Turner, in their application of chemistry to geology; and he had been requested by the Association to draw up a report of this application. He now brought forward his investigations on the most important of our mineral productions—namely, coal. Although some geologists may entertain a different opinion, he assumes for granted the vegetable origin of coal; and although it may be classified in various ways for economic or geological convenience, as into caking or not caking, bituminous or not bituminous, the true basis of the classification must depend on the chemical composition. Carbon, oxygen, and hydrogen, are the components of living vegetables, and the same elements compose coal, but in different proportions. He distributed among the Members copies of the annexed table, exhibiting the approximate constitution of several varieties of coal, their relation to lignin, or woody fibre, and to each other. In the decomposition of vegetable matter there are two agents always at hand—viz. atmospheric air and water, which resolve it into carbon, oxygen, and hydrogen, forming with one another those combinations—carburetted hydrogen, carbonic acid, and water. Vegetable matter consequently in different states showed different proportions of these elements, and in the table we see the composition of vegetable matter in various fossil states. The quantity of carbon in all the different varieties of coal in the table was taken as a constant quantity; and from lignite downwards we see a progressive loss of hydrogen and oxygen, until, in anthracite, the carbon is the chief component.

Name.	Formula.	Loss compared with Lignin.	Loss compared with preceding variety.
Lignin	$C_{160}\ H_{128}\ O_{128}$		
Fossil Wood, (Usnach)	$C_{160}\ H_{97}\ O_{79}$	$H_{31}\ O_{49} = 31\ HO + 18\ O$	$31\ HO + 18\ O$
Do. (Teesdale) at 300 F.	$C_{160}\ H_{80}\ O_{70}$	$H_{48}\ O_{58} = 48\ HO + 10\ O$	$9\ HO + 8\ H$
Imperfect Lignite (Greece)	$C_{160}\ H_{78}\ O_{48}$	$H_{50}\ O_{80} = 50\ HO + 30\ O$	$2\ HO + 22\ O$
Lignite (Lower Alps)	$C_{160}\ H_{70}\ O_{38}$	$H_{58}\ O_{90} = 58\ HO + 32\ O$	$8\ HO + 2\ O$
Jet	$C_{160}\ H_{68}\ O_{28}$	$H_{60}\ O_{100} = 60\ HO + 40\ O$	$2\ HO + 8\ O$
A Steam Coal } Dry Blazing Coal, (Blanzy)	$C_{160}\ H_{65}\ O_{26}$	$H_{64}\ O_{102} = 64\ HO + 38\ O$	$2\ HO + 2\ H$
Imperfect Cannel (Clifton)	$C_{160}\ H_{64}\ O_{16}$	$H_{64}\ O_{112} = 64\ HO + 48\ O$	$HO + 9\ O$
Cannel (Wigan)	$C_{160}\ H_{64}\ O_{13}$	$H_{64}\ O_{115} = 64\ HO + 51\ O$	$3\ O$
Splint (Willington)	$C_{160}\ H_{60}\ O_{11}$	$H_{68}\ O_{117} = 68\ HO + 49\ O$	$2\ HO + 2\ H$
Caking Coal (Newcastle)	$C_{160}\ H_{56}\ O_{8}$	$H_{72}\ O_{120} = 72\ HO + 48\ O$	$HO + H$
A Steam Coal } Hard Bituminous (Rive de Gier)	$C_{160}\ H_{52}\ O_{6}$	$H_{76}\ O_{122} = 76\ HO + 46\ O$	$2\ HO + 2\ H$
Anthracite A (Mayenne)	$C_{160}\ H_{42}\ O_{4}$	$H_{86}\ O_{124} = 86\ HO + 38\ O$	$2\ HO + 18\ H$
B (Welsh)	$C_{160}\ H_{33}\ O_{3}$	$H_{95}\ O_{125} = 95\ HO + 35\ O$	$HO + 8\ H$
C	$C_{160}\ H_{24}\ O_{3}$	$H_{104}\ O_{125} = 104\ HO + 21\ O$	$9\ H$

This is also borne out by experience. In the change from lignin to fossil wood, we find that carbonic acid only is parted with; and this continues without variation in all the kinds down to cannel coal. In mines of lignite and cannel coal, we find only carbonic acid, or choke damp; while in mines of coal lower in the scale, we find in addition carburetted hydrogen, or fire damp, and this is shown also in the table,—the hydrogen diminishing in each variety as we approach anthracite. In some mines we find a confirmation of this theory. We find in some Yorkshire mines coal of different kinds, cannel coal being at the top, evidently proving that those below having been longer subjected to chemical action, had parted with more of their hydrogen. The same occurs in mines in Lancashire; and a section, in illustration, is contained in Mr. Murchison's work on the Silurian system. Prof. Johnston then entered into a consideration of what was the source of all this vegetable matter that formed coal. Had it been drifted, or had it been generated on the spot? He was inclined to the latter opinion; and it was the opinion of the practical miners in the north of England. He mentioned some of their arguments for this opinion. Coal is often found mixed with clay; and many successive layers of coal occur one above another; but, above all, a very thin bed of coal is often found extending a considerable distance, and which they conceive could not have been drifted, but must have been derived from plants that had grown upon the spot.

Mr. Phillips considered that we could not as yet decide upon the drifting or non-drifting of the vegetable matter which formed the coal, as there were many arguments on both sides. Coal is found replacing parts of plants, which parts have been brought from some distance; and although in some instances we may observe fossil plants with their roots attached, yet great caution should be used, as they were often deceptive evidence; he had seen fossil stems attached to roots of a plant of a different species. It was also desirable to remark, that in different formations coal resulted from different plants. In the oolitic strata were small beds of coal originating from different plants than those of the regular carboniferous strata.—Mr. Featherstonhaugh mentioned the great developement of carboniferous strata in the United States, where there were no oolitic strata; and he confirmed Mr. Johnston's views of the composition of coal, from the descending series in that country ending in anthracite,—this last commencing where the bituminous coal ended. In some places the anthracite becomes a kind of graphite, or black lead, that may be made into pencils. The anthracite descends into rocks of the Cambrian age, and into graywacke, where he has found it presenting a filamentous appearance. He mentioned, also, the discovery, by Mr. R. C. Taylor, of beds in Cuba like the Newcastle beds, and the substance contained in them had been afterwards found to be indurated bitumen, like that of Trinidad. This could not be included in the same category as bituminous coal; and he conceived the same may be observed of anthracite.—Dr. Buckland instanced the asphaltum found near Lyons, in the upper oolite, and resembling coal, and that found near Neuchatel in tertiary strata: these were not of vegetable origin. In Trinidad, the bitumen poured out of the different sources would in time assume a similar appearance. He mentioned, also, Dr. Lindley's experiments on the destruction of plants. Grasses immersed in water became very soon altered, while ferns resisted its action for a very long time. These latter are common in the carboniferous strata. The thin bed of coal mentioned by Prof. Johnston may have been formed of matter from small plants that had been drifted; and he was of opinion that proofs of this drifting were common. He instanced the famous tree found at Craigleith, near Edinburgh, and others found near Glasgow, which had been described by Mr. Smith, of Jordan Hill.—Prof. Johnston asserted, in conclusion, that bituminous matter must be of vegetable origin; in fact, chemistry proved it. Distillation of vegetable matter in a gas-work, or in the laboratory of a volcano, was the same process.

'On Ancient Sea Cliffs and Needles in the Chalk of the Valley of the Seine, in Normandy,' by C. Lyell, Esq., F.R.S.

The observations in this paper are principally confined to that part of the winding valley of the Seine, which extends from Andelys to Elbœuf, a distance by the river of about thirty miles. This valley, which is from two to four miles wide, has been excavated through chalk with flints horizontally stratified, and about 300 or 350 feet in thickness, and a mass of overlying tertiary sand, gravel, and clay, from 30 to 100 feet thick. The last-mentioned deposit constitutes a level platform, differing wholly in character from the chalk downs in England; but the slope of the hills bounding the Seine and its tributaries, where the chalk crops out, corresponds exactly in character

with the escarpments of the North and South Downs (in England). There is, however, this distinction, that the escarpments of the valley of the Seine, which are distant from two to four miles from each other, are broken at certain points by ranges of vertical and even overhanging cliffs of bare white chalk with flints, and by occasional needles and pinnacles of chalk. Mr. Lyell first referred to several natural precipices of chalk, which occur some on the right and some on the left bank of the Seine, above Andelys, or between that town and Meulan, about fifteen miles in a straight line from Paris. In one of these localities, near Bonnières, two distinct cliffs are seen, one above the other. He then described more particularly a great range of cliffs, about two miles long, at Andelys. 2ndly, another range and some pinnacles at Vatteville, opposite Tournedos, and at Senneville; and 3rdly, the cliffs of Elbœuf, or Orival. In regard to the first of these ranges, it commences on the right bank of the river, at Le Petit Andelys, and includes the rock on which stands Château Gaillard. The base of the range is generally about fifty feet above the alluvial plain of the Seine, from which it is separated by a steep green slope, resembling in outline a talus of fallen debris, but in many places composed of solid rock. The inland cliffs themselves vary from fifty to a hundred feet in perpendicular height, their continuity being broken by a number of dry valleys or combes, in one of which, near Andelys, occurs a detached rock or needle called the Tête d'Homme. The top of this rock presents a precipitous face towards every point of the compass; its vertical height being more than twenty feet on the side of the downs, and forty towards the Seine; and the average diameter of the pillar being thirty-six feet. Its composition is the same as that of the larger cliffs in its neighbourhood, namely, white chalk, having occasionally a crystalline texture like marble, and layers of flint in nodules and tabular masses. The flinty beds often project in relief four or five feet beyond the white chalk, which is generally in a state of slow decomposition, either exfoliating, or being covered with white powder, like the chalk cliffs on the English coast, and like them, the surface of the rock is in some places encrusted with common salt. In regard to the origin of this superficial salt, it is difficult to conceive that the influence of the sea breezes can extend so far, as the distance is more than thirty miles from the nearest salt water; but, on the other hand, the author could not ascertain that any saline matter was contained in the chalk itself. Other cliffs are then mentioned, situated on the right bank of the Seine, opposite Tournedos, between Andelys and Pont de l'Arche, where the precipices are from fifty to eighty feet high: several of their summits terminate in pinnacles, and one of these in particular is so completely detached as to present a perpendicular face fifty feet high towards the sloping down. On these cliffs several ledges are seen, which, in the author's opinion, mark so many levels at which the waves of the sea encroached for a long period. There are also, above the summit of all the cliffs, three distinct parallel terraces, and as many cliffs, each about four feet high, which sweep round a small combe in a semicircular form, like the seats of an amphitheatre. If we then descend the river from Vatteville to a place called Senneville, we meet with a singular insulated needle, about fifty feet high, perfectly isolated on the escarpment of chalk on the right bank of the Seine. The third or last range of inland cliffs referred to is situated about twelve miles below, on the left bank of the Seine, beginning at Elbœuf, and comprehending the Roches d'Orival. Like those before described, it is in part overhanging, exhibits a white powdery surface, and consists entirely of horizontal chalk with flints. Its base is only a few feet above the level of the Seine; its height in some parts exceeds 200 feet. It is broken in one place by a pyramidal mass or needle called the Roche de Pignon, which stands out about 25 feet in front of the upper portion of the main cliffs, with which it is united by a narrow ridge about forty feet lower than its summit. Its height is about two hundred feet, and, like the detached rocks before mentioned at Senneville, Vatteville, and Andelys, may be compared to those needles of chalk which occur on the coast of Normandy, as well as in the Isle of Wight, and in Purbeck. The author then states, that while there are in some places marks of cliffs and terraces at six or more distinct levels, there is sometimes only one range of cliff, which may be a few feet or more than 200 feet in vertical height; and on the other hand there is often no outbreak of bare rock or precipice, as is well exemplified in that part of the valley where the Côte des deux Amants faces that of Pont St. Pierre. The cliffs, where they do exist, are usually confined to one side of the river, whether on the right or left bank. Various causes are assigned for this partial occurrence of ancient cliffs, and the variety of their number and elevation where they exist. It is assumed that the valley of the Seine was excavated by the waves and currents of the sea, during the slow, and probably intermittent, upheaval of the land. When the denuding operations, therefore, were in progress, the valley constituted a channel of the sea between two islands or two opposite coasts. Considerable cliffs could be formed at those points only against which the waves and currents set with peculiar force. Being thus originally partial, they subsequently became more rare by the obliterating action of frost and rain. It would also happen occasionally that a series of smaller cliffs would be united into one, when the undermining force of the sea caused it to encroach greatly at a certain point.

In the conversation that followed, it was stated that saline incrustations were found on the surface of chalk far inland in England, and Prof. Johnston considered the salt must exist in the chalk itself, perhaps deposited in its pores by running waters, all containing a small quantity of it.

It was announced by the President, that arrangements had been made for an excursion, on the following day, to the island of Arran; and he directed attention to a model of the island, constructed by Mr. A. C. Ramsay; also to a geological map and drawings, by the same gentleman, whom he then requested to make a communication on the geological features of the island, which would put the members in possession of the necessary information, before starting on the excursion.

Mr. Ramsay stated, that the whole of the interior and more northerly portion of Arran is a mass of granite, forming the lowest rock of the series: this is surrounded by stratified formations, ranging from primary schists to sandstones belonging to the coal formation, described by Sedgwick and Murchison as the new red sandstone. The schistose rocks are much contorted, and contain innumerable quartz veins, often lying in laminæ parallel to the stratification, at other times penetrating it laterally. On these slates repose old red sandstone with its conglomerate, containing pebbles of schist and quartz, but no granite. Some of these quartz pebbles are rolled as if derived from a distant mass, now not existing; others are angular, seemingly imbedded in the conglomerate immediately on separation from the parent mass; probably from the veins in the schist, the softer material of which forms part of the cement of the conglomerate. The anticlinal line is in the centre of the old red sandstone, at North Sannox, and at its either extremity the coal measures dip to the north and south. To these succeed a newer red sandstone. The southern portion of the island is composed of masses of trap, porphyries, and syenites; bursting through and overlying the sandstone, they exhibited beautiful examples of penetrating dykes. There seems to have been a tranquil deposition of these various formations, no violent upheaving or depression: in proof of which the slate may be observed gradually merging into the old red sandstone, as in North Sannox Water, where there are several alternations of slaty conglomerate with the common puddingstone. At the Fallen Rocks, and on the boundary of Achat Farm, the old red sandstone assumes a conglomerate form; but before passing into the coal measures, we find its component pebbles inclosed in carbonate of lime, forming a calcareous conglomerate, succeeded by ordinary beds of limestones, shales, and sandstones. It is equally impossible to define the boundary of the coal measures and overlying sandstone. Mr. Ramsay concluded that, from this want of sudden change in the formations, they were deposited tranquilly in the bottom of the sea. In the northern parts of the island, from the fact of no granite fragments being found in the surrounding formations, the granite must be regarded as the newest rock. It often sends veins into the slate, but when raised to its present elevation it could not have been in a state of fusion, from its being never found overlying the slate, which has evidently been fissured, and partly elevated before deposition of the old red sandstone. There are two granites distinct in character, the one coarse-grained and crystalline, the other fine and softer: the former being near the slate, the latter in the central district. There seems to be a junction of them at the back of the Ben Noosh ridge. Veins of the fine granite penetrate the coarse, which latter is also traversed by trap and pitchstone dykes, but no dykes have been discovered in the fine granite, which appears to cut them off, when they approach it in the coarser rock. It is probable that this fine granite is newer than the trap formation, as it is found associated with it at the head of Glendhu, and sends veins into the newer red sandstone. This granite had been discovered by Mr. Ramsay in 1837, in Glendhu, and was not marked in any previous map. With respect to the recent elevation of Arran, an argument is afforded by the existence of an ancient sea cliff, the bottom forty feet above the present sea level, that surrounds the greater part of the island. In the slope from the bottom of the cliff to the present sea-beach are found recent shells similar to those now occurring on the shores; these shells even occur at the entrance of the water-worn caves in the cliff. These caves are inclined to the south, almost in the direction of the anticlinal line, with their pillars at right angles to the stratification, and not to a horizontal plane, indicating clearly their elevation. Between this cliff and the sea are numerous boulders of granite; these, in many cases, do not rest on their broad ends, but on narrow bases, as if, when within the range of action of the waves, the lowest portion had been washed away. The farther they are removed from the ebb-tide, the more do they assume the appearance of inverted cones. Near the coal beds, on the north-east coast, is a bed of reddish limestone, dipping north-east towards the sea, and six or eight feet above its present level, having its surface honeycombed by former action of the waves, and containing perforations made by pholades. The quartz veins in the slate owe perhaps their origin to electric currents, aided by the contact of the slate with the heated mass of the granite. Near the granite it appears to have been partly fused in several cases; and it exhibits great contortions to the distance of a mile and a half from the granite. Sometimes it assumes a granular appearance, like the igneous rock. Mr. Ramsay considered that these phenomena might be connected with Prof. Keilhau's theory.

In the conversation which followed, Mr. Ramsay mentioned, that in Arran he had collected some data respecting the growth of peat, which was unequal in different places. In the time of Cromwell a number of trees had been cut down, and since that period there has been a growth upon them of six and a half feet of peat. In another place, where Danish weapons had been found, there had been a growth of only three feet, although many centuries must have elapsed.—Mr. Murchison alluded to the erroneous mode of marking the sandstones in Macculloch's Map of Scotland, they being indicated by one colour.—Mr. Menteith, Dr. Buckland, and Mr. Knipe particularly instanced Dumfriesshire, which had both sandstones, although so coloured.

The next paper was by Mr. William Keir, 'On the Geology of Castle Hill, Ardrossan.' It is situated at the north-west extremity of the great Scotch coal field. On the north side of Ardrossan quay may be seen the old red sandstone dipping beneath the coal; the pier is built on a trap dyke, and the baths upon another; between them the coal strata run into the sea at angles highly inclined. The Castle Hill is formed by an eruption of trap, chiefly in the condition of claystone and clinkstone, with a vein of green serpentine running through it, without rising to the surface. In cutting for the railway, this vein has been exposed, and a portion removed. At first it was dark green, very brittle, and frequently coated with steatite; it then became darker in colour, and more compact, and is now becoming like ordinary greenstone. The claystone of the hill appears to have been fissured by the eruption of the serpentine; the fissures are filled with drift, in which are many fragments that bear such marks of fusion as to resemble scoriæ; they have often a ceiling of stalactite,

and a floor of stalactitic conglomerate, formed of water-worn pebbles and recent sea shells, proving the elevation of the rock, the cavernous part being thirty feet above the present tide level. A little higher, in a sheltered spot, is a bed of recent shells, *littorina vulgaris* and *patella vulgaris*, which have been brought there in storms.

Mr. Sanders gave an account of a raised beach at Woodspring Hill, eighteen miles west-south-west of Bristol, and two miles north of Weston-super-Mare; it is called Middle Hope on the Ordnance map, and is composed of mountain limestone. The shells occur at an elevation of twenty-five feet above ordinary spring tides, and were chiefly *tellina solidula*, *littorina communis*, and *neritoidea*, with a few *patella vulgaris*, all recent species.

Saturday.—Excursion to Arran.—According to announcement, about eighty members of the Geological Section started by railway to Ardrossan, whence they proceeded by steamer to the island of Arran—while another party went direct from Glasgow. The day was remarkably fine, and afforded an excellent opportunity for examining the geology of this interesting locality. The parties met at Brodick Harbour, and thus united, proceeded to Brodick Castle, where they were hospitably welcomed by the Marquis of Douglas. On their return, and before landing at Ardrossan, the party took a farewell look of the Arran Hills, which were clothed in all the glories of a September sunset. There was a splendid panorama of mountain scenery in every direction to which the eye turned; perhaps the most interesting points being the Paps of Jura, which, though not often visible, were, on this beautiful evening, well defined in the distance.

Section D.—Zoology and Botany.

Friday.

P. J. Selby, Esq. in the chair.

Sir John G. Dalyell read a paper 'On the Regeneration of lost Organs discharging the Functions of the Head and Viscera, by the Holothuria and Amphitrite, two marine animals.' The adult holothuria resembles a cucumber, or a sausage, from six to twelve inches long, purple, yellow, grey, or white. Some thousand suckers cover it like a shaggy coat, or disposed in rows according to species, affixing it firmly to solid substances, where it remains quiescent in a crescentic form during the day. But when evening comes, a tuft, protruding from the larger extremity of the crescent, unfolds into a capacious funnel, composed of eight, or ten, or twenty beautiful branches implanted on a shelly cylinder, in the centre of which is the mouth. Each branch now begins to sweep the water in succession, and descends almost to the root within the mouth, in a contracted state, whence it arises to enlarge anew. These evolutions are protracted until the latest hour; but as morning dawns, the whole apparatus is withdrawn, the skin becomes close and compact as before; and a fountain begins to play from the opposite extremity. This singular animal is liable to lose all the preceding organic apparatus, consisting, in the *Holothuria fusus*, of eight larger and two smaller branches (*tentacula*), together with the cylinder, mouth, œsophagus, lower intestinal parts, and the ovarium, separating from within, and leaving the body almost an empty sac behind. Yet it does not perish. In three or four months all the lost parts are regenerated, and a new funnel composed of new branches as long as the whole body of the animal, begins to exhibit the same peculiarities as the old one, though longer time be required to attain perfection. Other species of the holothuria divide spontaneously through the middle, into two or more parts,—all becoming ultimately perfect, by the developement of new organs. Yet the anatomical structure of the whole genus is so complex as to defy the skill of anatomists in discovering the proper functions of some of the parts. A single holothuria has produced 5,000 ova in the course of a night. The young resembles a white maggot, when the size of a barley-corn. The animal may lose and regenerate its organs more than once: it is very rarely to be procured entire; nor until the drawings now laid before the Association, has it been even represented alive and perfect. A specimen survived with Sir John about two years.—2. The amphitrite is an animal still more interesting, from the faculties it possesses, and the properties which it enjoys. Various species inhabit the Scottish seas, all occupying tubes either of their own manufacture, by a process truly mechanical, or in a thin silken sheath formed by an exudation from the whole body, or they rest amidst a thick tubular mass of transparent jelly, also of animal secretion. The body of the *Amphitrite ventilabrum* extends twelve inches or more in a serpentine form, consisting of 350 segments, crowned by a beautiful, varied coloured plume of eighty or ninety fleshy feathers, and terminated by a double gland. These (the branchiæ) are arranged as a funnel or shuttlecock, three inches deep, and resembling the finest flower, with two spines in the centre, and each feather is bordered by at least 500 cilia or fleshy hairs along the shaft. This, which is the most timid of creatures, dwells in a black, leathern-looking, perpendicular tube, two feet high, entirely of its own manufacture, rooted by the lower extremity. Singular to be told, the observer possesses the ready means of inducing the humble tenant to display its powers. If, while stretching its beautiful plume above the orifice of the tube, and spreading it to enjoy the circumambient element, let him drop a little muddy matter from above, an interesting spectacle ensues,—immediately all the feathered apparatus is seen in action, though the animal be apparently still. Forty thousand cilia are at work, and a mass is soon discovered accumulating at the bottom of the funnel. Being thence transmitted to the mouth, it is imbued with gluten, and discharged as paste on the edge of the orifice of the tube. There the creature, having raised itself still higher, performs a slow revolution while moulding the paste into proper form, by means of two organic trowels, prolonged from a fringe around the neck. With these it beats down the paste, and clasping over the edge of the tube, smooths its materials into symmetry as if it were by the operation of human hands;—but on the slightest alarm the plume collapses, the artist sinks below in an instant, and remains with the orifice closed until, believing the danger over, it may rise to resume its task in security. As specimens occur of different dimensions, let the observer cut a fragment off the lower end of the tube, which is always longer than the tenant: it will be affixed again where desired. Treating a number thus, and tossing them into a glass jar of sea water, a grove will arise before him from the animals fixing them anew, and protruding like so many revolving flowers, to collect muddy drops from above, with which he provides them. The adhesion is accomplished from a glutinous or silky sheath, which the double terminal gland seems instrumental in producing. Should the amphitrite be mutilated of the anterior part, the whole will be regenerated; nay, should a fragment of the smaller or posterior extremity be severed from the body, an entire plume, spines, mouth, and trowels, will be generated to crown the anterior part of this fragment, and render it a perfect animal. It is very remarkable, that the powerful reproductive property of the genus is not confined to the vicinity of the lost organs, the elements of others reside in different and distant parts of the body, from whence human perceptions cannot discover any likelihood of their evolution by means of their own energies. The adult *Amphitrite bombyx*, which obtains a silken sheath, merely by spontaneous exudation from the body, is about three inches long, of which a third part is the plume, consisting of 60 or 70 feathers (branchiæ). Two artificial sections of the body of a vigorous specimen speedily invested themselves with a sheath, wherein they reposed quiescent. The organization of the upper portion remained in its original state; the middle section acquired the wanting parts, and a plume of eight feathers was generated by the lowest section, though this section had been only two lines, or the sixth part of an inch, in length. Thus three plumes existed at once, with all their appurtenances, on what had been a single animal. Young animals have few branchiæ; their number augments with age; and both these and the number of segments in all the annelides seem indefinite. In all their ciliated branchiæ, likewise, the rib or shaft is originally bare, and clothed with the cilia developing successively upwards. (The paper was illustrated by numerous drawings of living specimens.)

In the course of the discussion which followed, Sir John gave various illustrations of the nature of the lower animals, and explained that he had kept them alive six, and even twelve years,—as of an actinia, still vigorous, in his possession, though at least twenty years old, the parent of 200 or 300 young.

Dr. Fleming said that Sir John was perhaps the only individual who had observed the holothuria in a living, healthy state. Specimens generally obtained were too much damaged for useful observation. He hoped that Sir John would present a report on the habits of the lower orders of the *Radiatæ* at their next meeting, and publish his original observations on natural history.—Mr. Forbes observed, that some of the holothuriæ mentioned, were now placed in other genera—one was *Mulleria*, and the *H. lactea* was now *Ochnis*, which genus is characterized by possessing a gizzard. The great differences which these animals present in different stages of growth, on account of the loss and reparation of their organs, had led to great confusion in their classification. Jager, a German naturalist, had given a classification of holothuriæ from dead specimens, which was exceedingly erroneous, as he does not seem to have been aware of the difference that may exist between the internal and external organs of two individuals of the same species, arising from the above cause. Muller's figures of holothuria were all ruptured; indeed the animals can seldom be taken perfect. One cause of this he had lately discovered in dredging in the loughs of Ireland. In these loughs the bottom of the water was salt, and contained marine animals; but the surface of the water was fresh, in which no marine animals could live. In taking the animals from the deep water, they were generally put into vessels containing water from the surface, and were thus placed in a medium in which they could not exist. In one of the loughs in Ireland he found specimens of *Mulleria* buried in the sand in crevices of the rocks around its border.

Mr. James Wilson exhibited three cases of insects from Persia, Serampore, and Java, interesting as exhibiting a correspondence in genera from widely-separated districts.—The Chairman observed, that among the insects from Persia he recognized many forms similar to those which he possessed in a collection from Greece.

A memoir 'On the Pollen and Vegetable Impregnation,' by Dr. Aldridge, of Dublin.—The author having discovered that nitric and other inorganic and organic acids produced the dehiscence of pollen-grains, in the same manner as if placed on the natural stigmatic surface, instituted a number of experiments, of which the following are the general results:—1. The spore of cryptogamic vegetables, which some botanists consider analogous to pollen, do not dehisce under the influence of acids. 2. The pollen of the grasses is spherical, both when dry and placed in water; with acids it bursts, protruding one long cylindrical mass, which remains afterwards unacted upon by the liquid. 3. The pollen of the Aroideæ, Colchicaceæ, Smilaceæ, Liliaceæ, Commelinaceæ, Bulomaceæ, Amaryllidaceæ, Iridaceæ, and Conaceæ, are, when dry, oval, and marked with a dark neutral line, but become, when placed in water, more broadly oval or circular, the long diameter remaining the same, and the opaque line disappearing, after the addition of acid; the external membrane of the pollen or peripollen dehisces by a chink or suture sufficiently broad to permit the contents or endopollen to escape without any alteration in its form, after which the endopollen remains unacted upon by the liquid. 4. In the Salicineæ, Salicariæ, Leguminosæ, Rosaceæ, Crassulaceæ, Saxifragaceæ, Hypericaceæ, Rutaceæ, Hippocastaneæ, Resedaceæ, and the tribe Helleboreæ of the Ranunculaceæ, the pollen when dry, oval, and marked with a dark central line, becomes, when placed in water, round, or nearly so, the dark line disappearing; and when acted upon by acids, assumes a triangular form, and protrudes at three equidistant points cylindrical or club-shaped masses, very similar at their origin to tubes, and presenting the appearance of being enveloped by a membrane. 5. In the greater number of the remaining Dicotyledons examined, the dry pollen is opaque, and either broadly oval or spherical. 6. In the Ericaceæ and Epacridaceæ, the pollen grains, when dry, appear triangular, or oval in some instances, triangular or rhombic in others, according to the position in which they are examined. Having ascertained the results of acids on the pollen, the author was induced to examine the stigma, and in every case found that the stigmatic tissue gave indications

of an acid re-action upon litmus paper. The next question to be examined was, in what manner is the fertilizing influence of the male organs communicated to the ovale? After quoting the opinions of Amici, Brown, Fritzche, Corda, Treviranus, Brongniart, and others, the author came to the conclusion that the *boyaux*, or intestine-like protrusion from the pollen grains, was the result of the action of acids upon the fluid which contained the fovilla in the pollen grain; and he inferred this from the fact of this tube, or *boyau*, never being formed when the pollen grain is placed in water, but being constant when the grain is placed in acid. After describing and explaining the anomalous character of the pollen grains in Orchidaceæ, Fumariaceæ, Asclepias, &c., the author presented the following conclusions as the result of his researches:—1. The stigma is invariably acid; 2. It is in consequence of this acidity that the pollen bursts; 3. That by the same means the fluid contents of the pollen become coagulated, enveloping the fovilla, and assuming, according to the method of dehiscence, different and very remarkable forms. (The memoir was illustrated by an extensive series of drawings.)

Dr. W. Arnott stated, that Prof. Mohl had lately made an extensive series of observations on the forms of the pollen grain. He thought Dr. Aldridge's explanation of the nature of the *boyau* satisfactory, although it increased the difficulty of explaining the mode of impregnation. The triangular pollen grains mentioned would, he believed, in most cases, be found to be square, or four-cornered, their triangular appearance being a deception.—Dr. Balfour said it had been observed, in some cases, that the pollen was alkaline; if this were correct, it was remarkable, taken in connexion with the acidity of the stigma.—Prof. Link, of Berlin, thought Dr. Aldridge correct as to the nature of the *boyau*. He believed it was formed of a glutinous matter, like that of which the spider made its web.

Mr. Babington mentioned, that he had found the *Cuscuta epilinum*, or the Flax-dodder, at Burrishoole, in the county of Mayo, Ireland; and also in a field near to the Crinan Canal in Scotland. He also stated that it had been introduced into this country with the seed of the flax from the north of Europe; and that there was no doubt of its being distinct from the *C. Europæa* of Linnæus.—Dr. W. Arnott thought that it might be got rid of, by using seed from America instead of from the north of Europe. Plants frequently brought with them parasites from other districts,—of this he had seen an instance in France, where a species of Orobanche, which grows abundantly in Barcelona, had been conveyed with the seed of the plant on which it grew. The mode of getting rid of it would be to substitute seed from some other district.

A Committee was appointed at the last meeting of the Association, to examine various parts of the Coasts of Great Britain by the Dredge. The Report of this Committee was read by Mr. Forbes, and the results were as follows:—Mr. Forbes dredged the east and west coasts of the Isle of Man. The species taken are recorded in the dredging papers, which will be hereafter published. A great bank or bed of scallop and other shells runs from opposite Peel to the point of Ayre, a distance of seventeen miles or more. The dead and living shells were equal. It varies in distance from the shore from half a mile to five miles. From most parts of the coast it is distant four miles. Between it and the shore is a great tract of sand, in which animals are rare. The coast with which this bed runs parallel, is of pleistocene marl and sand, in places exhibiting traces of a similar shell bank to that existing in the sea. The characteristic shells of the fossil bed are, however, altogether wanting in the recent. Echinodermata abound in the recent bed. The east coast presented a different character. Off Laxey there is an oyster bank apparently of small extent. The rest of the sea bottom is milleporinæ. The most abundant shell is the *Pectunculus pilosus*. Scallops are very scarce, and shells of the Venus tribe not abundant. Sponges are plentiful, but Echinodermata scarce. A sub-committee dredged the west coast of Ireland. The testacea usually regarded as characteristic of the southern districts of Britain, were found on this coast, and extended as far as Donegal Bay. The province of Connemara must be excepted; the marine lough there presenting a northern Fauna similar to that found in the Highlands of Scotland and the Hebrides. In Clew Bay a deep-water Fauna was observed on a shallow bottom, accompanied by the geological phenomenon of a raised coast and islands presenting beds of shells *in situ*, at some elevation above high-water mark. The species of testacea were very generally distributed. Ascidian mollusca were abundant, but radiata were much more scarce than on the east coast. No instance of a true shell bank was observed. Dead shells were generally more abundant than living. Mr. Patterson dredged a portion of the east coast of Ireland, in the neighbourhood of Belfast. In the course of his researches he found dead shells usually more abundant than living; and with the exception of one or two species, the number of individuals of each form but limited. *Nucula margaritacea* was found in great abundance,—in many places much more abundant than the other species, which fact illustrates the circumstance of the nucula being characteristic of the newest tertiary formation. Papers filled up with the species taken, as well as the list of queries drawn up for the use of the dredgers, were laid before the Section.

Mr. Smith, of Jordan Hill, had been in the habit of dredging for years, and believed there were not so many new species to be found as was generally supposed, and therefore the labour would not be so great as might have been expected. Labours of this kind, although they might not be important to the conchologist, were very much so to the geologist.—Mr. Forbes had been much surprised at the result—not a single new testaceous mollusk was found on the west coast, and only a few new species of the naked mollusca. This was opposed to the prevailing opinion that our seas contained many new species.—Dr. Fleming thought it desirable that, in order to prosecute dredging with success, more should be known of the nature of the coast. Government coast surveys had now been going on for years, and it was most desirable that what had been done should be accessible to the naturalist. He was not surprised at the few new species found. Frequently rare species were widely scattered; whilst those that were abundant might be local. He once found the *Ciderella cristata* in great abundance, in one locality, and although he had often sought it again there, he had never found it; and the few he brought away the first day, he believed were the only British specimens that existed. He mentioned other instances in which he had found shells only once in abundance in the same place, although repeatedly visited again for the same purpose.

Mr. Patterson then read the Report of the Committee on Radiate Animals, which concluded as follows:—"Respecting the state of our knowledge of two divisions of the radiate animals, the Committee feel it unnecessary to furnish any report, these departments being undertaken by individual members of the Committee, whose researches are either published, or are now in course of publication (Johnstone's 'Zoophytes' and Forbes's 'Echinodermata'). With regard to the remaining portion, the Acalepha, they are persuaded it cannot be effectually investigated and illustrated, except when the artist and the naturalist are combined in the person of one individual. The Committee therefore beg leave to discontinue the further prosecution of their subject."

SATURDAY.

Sir William Jardine in the chair.

The Chairman exhibited the roots of a beech-tree, which had been sent to the Section by Sir Thomas Phillips. They were remarkable from having been produced in a tank of water, through the crevices of which they had penetrated, and they had thus become divided in an extraordinary manner.

Dr. Neill remarked, that the spongioles here were acicular, and that he had observed this to be the case in a plant of *Leuecio Jacobœa*, whose roots had been produced in water.—Dr. Walker Arnott said, all plants growing in the water have pointed extremities at their roots, and in many cases they possessed a distinct case or calyptra at the end; and he believed it would be found that roots in water terminated by aciculæ, and those in the earth by knobs.

The Secretary read a communication 'On an anomalous form of the Plum, observed in the gardens of New Brunswick,' by Prof. Robb.

After some general remarks on the character of the fruit-bearing trees of New Brunswick, which is not favourably situated for the developement of Rosaceous fruits, the author stated—In the summer of 1839 I had an opportunity of observing the progress of destruction among the plums. Before, or soon after the pieces of the corolla had fallen, the ovarium had become greenish yellow, soft, and flabby; as the fruit continued to grow, its colour became darker and of a more muddy yellow, and, at the end of a fortnight or three weeks, the size of the abortive fruit was fully greater than that of a ripe walnut, and resembled, in appearance, apricots. When examined, they were hollow, containing air, and consisting of a distended skin, insipid and tasteless. By and bye, a greenish mucor or mould is developed on the surface of the blighted fruits, which becomes black and shrivelled, and, at the expiration of a month from the time of blowing, the whole are rotten and decomposed. The flower appears about the beginning of June, and before August there is hardly a plum to be seen. The changes producing these anomalous forms of the fruit, were explained on the admitted principles of morphology. The differences from a normal form of the fruit would be found as follows:—The exocarp is yellow and wrinkled, not smooth and red or black; while the mesocarp is as little developed as if the protophyllum had become a leaf. Its cells are loose and dry, while the vessels, large, and very prominent, are discerned passing through it. The two largest sets of vessels run up along the inner surface of the groove or suture, corresponding to the line along which the edges of the protophyllum are united, and those which correspond with the radicle in the protophyllum. They all anastomose and converge towards the apex, where all contribute to form portions of the style and stigma. The endocarp was small; it was attached by vascular fibres, but sometimes adhesions existed between it and the mesocarp, on which it lay. Sometimes it was attached near to where the style was given off, in other instances it was midway between that point and the peduncle. In some cases it was empty; mostly one or two ovules might be seen; and one was generally smaller than the other, indicating its deficient nutriment. Each ovule was made up of three transparent shut sacs, the innermost of which (the tercine) contained a transparent fluid, and nothing more. The author supposed this anomalous form of fruit to be influenced in its production by cold winds and long-continued rains at that season at which the flower is open, and the reproductive organs the most exposed to atmospherical vicissitudes. It was popularly attributed to insects; but, from not having observed any, he did not think this could be the cause.

Dr. Walker Arnott thought the author wrong when he stated that the endocarp of the fruit represented the epidermis or epiphyllum of the normal leaf. The real fact was, that the shining membrane on the interior of the endocarp was the true representative of the epiphyl. He believed that these plums were produced by the attacks of insects, as he had frequently seen anomalous forms of fruit produced in that way. An early examination of the flower would probably have detected them. Moist weather produced a contrary effect on vegetation, and was favourable to the developement of leaves rather than fruit.—Dr. Lankester related some instances of abnormal developement of leaves and other parts from the attacks of insects, especially from the deposition of ova in the tissues.

Mr. James Wilson exhibited a series of specimens illustrating Mr. Shaw's (of Drumlanrig) views on the developement and growth of Salmon-fry. Mr. Wilson read a portion of an article on this subject by Mr. Shaw, which appeared in the 14th volume of the Transactions of the Royal Society of Edinburgh. The series of experiments last performed by Mr. Shaw seem to have satisfactorily settled the question, that the fish called the parr is but one form of the fry of the salmon, and that the differences of opinion on this point have resulted, 1st, from the varying time which the young fish remain in the rivers—from fifteen months to two years; and, 2ndly, the different dress or colour which they assume during their growth.

Sir W. Jardine thought the question of the nature of parr was set at rest by Mr. Shaw for ever. He had witnessed the places in which the experiments had been performed, and, from the care which had been taken to make the ponds as much like their natural haunts as possible, he had no doubt of the

correctness of his conclusions. Mr. Shaw was now trying a series of experiments on the sea-trout, which he made no doubt would be interesting to naturalists —the fry were hatched in January, and in May last were one inch and a quarter long.—Mr. Lingwood had seen parr longer than six inches, which was about the size that they appeared to migrate.—Sir W. Jardine: Parrs frequently attain the size of eight or nine inches, but they do not exist in any great numbers, and appear to be those that remain longer than usual in the rivers.—Dr. Lankester wished to know if any structural difference existed between the salmon at various periods of growth, or whether any difference existed in different individuals of the same species, especially with regard to the number of the rays in their fins. He asked this question, for he had been lately wishing to determine some species of bream, and found the rays of the anal fins varying from eighteen to thirty, and thus destroying the specific distinction between *Abramis brama* and *A. blicca*. This, however, was not the only point of difficulty, as the relative size of the parts varied also very much; and, from these circumstances, he was induced to think that the *A. blicca* was only an early stage of growth of *A. brama*.—Sir W. Jardine was not aware that any difference existed in the number of the rays of the fin at various stages of growth, but he had observed a very decided difference in the form of the pectoral fin at various stages of growth, as might be seen by the specimens on the table. The number of rays in the fin he thought a bad specific distinction, and was not to be depended on among the Salmonidæ. It was so with regard to the bream, as on a late visit to Scotland Mr. Yarrell had found great difficulty in distinguishing the species of bream, on account of the varying number of the fin rays.—Mr. Forbes stated, it was laid down as a rule in zoology, that those parts which characterized a class were those, the differences of which were most to be relied on in specific distinctions. Now, the fins were such an organ in the fish; and it was an exception to the rule if, in any families of fishes, they were not amongst the parts whose difference of structure should point out the most permanent characters.

Mr. Adair exhibited some specimens of the *Patella ancyloides*, found on the coast of Arran.

Mr. Forbes stated, that this shell, if picked up in a river, would be called an *Ancylus*: it is not really a *Patella*, but a *Lottia*. It has a shell of one order of animals, and the animal which inhabits it belongs to another order of animals. Patella may be distinguished from Lottia by its habitat, the latter living in the depths of the sea, while the former cannot exist in such a locality.

Section E.—MEDICAL SCIENCE.

FRIDAY.

Dr. M'Kay read a paper 'On the Properties, Chemical and Therapeutic, of the Matias Bark.'—The plant from which the bark was obtained, he stated, grew in great abundance in South America; but he was unable to state its botanical characters. From what he had heard he supposed it to belong to the genus Wintersonia. In its native country it was extensively used as a substitute for cinchona bark in intermittents. It was found to contain an intensely bitter extractive matter, to yield on distillation two distinct essential oils, differing in specific gravity, soluble in alcohol and æther, but very sparingly so in water. The principal characteristic substance derived from it was a bitter resinous matter; no alkaloid was discovered to exist in it. Specimens of the bark, its extract, the essential oils, tincture and resinous matter, were exhibited. The principal therapeutic properties were stated to be tonic, aromatic, and astringent. Dr. M'Kay also stated that it had been exhibited with marked success in dyspepsia accompanied by loss of appetite, which it quickly restored,—in phthisis, where tonics were admissible, in which it supported the strength, and prevented rapid sinking; in dropsy it was found to be a valuable adjunct to diuretics; in intermittents it was found to be a valuable substitute for the cinchona. It was also found serviceable in such cases of hemicrania, as permitted the use of quinine.

Dr. Newbigging, from extensive use of the drug, corroborated the statement made of its therapeutic virtues.

Dr. M'Kay then exhibited to the Section drawings of a monocephalous double human fœtus, and read a paper minutely describing its peculiarities of structure. Its principal characteristic, he stated to be, its being so completely monocephalic, with double extremities; the cerebral nervous system was single, the spinal and ganglionic double, the viscera of the thorax and abdomen were of a mixed character.

Dr. Newbigging read a paper 'On the Therapeutic effects of Croton Oil in certain affections of the Nerves.'—He observed that for some time the only action it was supposed to possess on the animal economy, was that of active purgation, until Sir Charles Bell pointed out its effects on neuralgia. Not that it would be found to remove the affection in all cases, which was impossible in those depending on certain organic changes. He then detailed a number of cases to prove that it possessed a specific power over the nervous system, independent of its general action as a purgative. The diseases in which the power was exhibited were severe sciatica, which had baffled every other treatment; convulsions in children, and epilepsy, many cases of which it cured; and even in those depending on organic affections of the brain, it rendered the paroxysms less frequent and more moderate. In a case of severe laryngismus stridulus occurring in a child nine months old, Andral exhibited it in minute doses with complete success.

Dr. Abercrombie said he had long used it extensively in affections of the head, and from his experience of it he thought it might possess specific power over the nervous system. As the disease laryngismus stridulus was alluded to, he would mention a remedy he had found very valuable in its treatment, which was a combination of carbonate of iron and rhubarb with musk.—Sir C. Bell had found several forms of severe neuralgia, particularly occurring in the extremities, as in the finger or toe, over which croton oil had no power. It was in facial neuralgia that it proved most serviceable, or in neuralgia occurring elsewhere, accompanied by some indication of cerebral affection. When he considered the great extent of the intestinal tract, and that those diseases may depend on sympathy with different parts of it, he was prepared to expect the necessity of using different purgatives which were known to act principally on different portions of the intestines.

Dr. Lawrie read a paper 'On the Results of Amputations,' in which he gave tables stating the results of 276 amputations which took place in the infirmary of Glasgow, during several years. The cases were classed from the sex, the limb operated on, and from the causes rendering the amputation necessary, whether from disease previously existing or from accident. Some of those results were as follows: of the 276 cases, 216 were males, of whom 86 died: 60 were females, of whom 14 died; 153 were for previous disease, of whom 35 died. In operations at the shoulder the deaths were equal to the recoveries; of the arm, the deaths to recoveries were as 3 : 14; in the leg, as 1 : 2; in the wrist, at one period, as 1 : 29; in another period as 8 : 22.

The question of primary or secondary amputation in cases of wounds was discussed, and the preference given to secondary. Immediate dressing was approved of. The impropriety of operating during the shock was insisted on. The cause of death was examined, and found frequently to exist in the viscera, particularly in the lungs.

'On the Anatomical relation of the Blood-vessels of the Mother to those of the Fœtus in the Human Species,' by Dr. John Reid.—In this communication it was proved, by preparations laid on the table, that numerous tufts of the placental vessels pass through the decidua, and enter by the open mouths of many of the uterine venous sinuses of the mother. Some of these tufts only dip into the open mouths of the sinuses; others extend their ramifications half an inch, and even in some rarer cases, more than an inch from the point at which they enter. That these tufts found bathed in the maternal blood of the uterine venous sinuses, are prolongations of the fœtal placental vessels, was proved both by injection and by microscopic examination. Dr. Reid then proceeded to state, that on examining the placental vessels under the microscope, each minute branch of the umbilical arteries is bound up with a single branch of the umbilical vein, and that they go on dividing and subdividing in the same manner—each subdivision consisting of an artery and a vein so closely bound together, as to resemble a single vessel, when seen through the microscope in their uninjected state. All of these branches—each including an artery and a vein—terminate in blunt extremities, and there is no cellular tissue filling up the intervals between them. These blunt extremities, in which the branches of the tufts end, form the termination of the arteries, and the commencement of the veins. The inner coat of the venous system is reflected upon the placental tufts which project into the uterine sinuses, and is prolonged over the surface of all the placental vessels, forming sheaths enveloping each branch of these vessels, and thus constituting a kind of sac with numerous and intricate folds, or fringes projecting into its interior. Into this sac, the blood of the mother is poured by the curling arteries, and returns by the prolongations of the uterine veins. Each of the uterine sinuses into which the placental tufts project, may be considered a minuter representation of the structure of the placenta, for we have there fœtal placental vessels resembling the branchial vessels of aquatic animals, covered by a prolongation of the inner coat of the vascular system of the mother, and hanging in a cavity filled with maternal blood.

The President observed that this communication was of great value. The subject was new, and the information given threw light on one of the darkest points of physiology.—Dr. Martin Barry and Prof. Thomson also spoke to the importance of this communication—and it was resolved that it should be printed.

Dr. Reid communicated a paper by Dr. R. M. Glover, 'On the Medicinal Action of Bromine and its Compounds.'—The principal conclusions from the experiments made to ascertain its physiological action were as follows: whether bromine be taken into the lungs in the form of vapour, or in the fluid form into the stomach, or be injected into the circulation, it acts purely as a corrosive and irritant; the action on the primæ viæ is different from that of hydrobromic acid, into which bromine is converted when absorbed into the circulation. The author extends this observation by analogy to chlorine and iodine, and their hydracids. Bromine exerts an action on the rectum like that of iodine; it is also tonic and diuretic; its remedial virtues are chiefly conspicuous as an external application in the treatment of scrofulous, syphilitic, malignant, and specific ulcers; in these cases, it appears to act as an excitant, and perhaps as a mild caustic; it is also useful in some chronic diseases of the skin. The bromides of potassium, sodium, and mercury resemble much more the chlorides of these bases than the iodides, in their physiological action. The bibromide of mercury has no advantage over the bichloride as a remedy, contrary to what has been asserted by some French writers. The bromide of cyanogen possesses a double action; in a powerful dose it operates like prussic acid, in a moderate one it produces the most violent symptoms of irritant poisoning, and is perhaps the most powerful irritant known. Ammonia is its best antidote. The chlorides and bromides of olefiant gas exert a remarkable action, introduced either into the stomach or circulation: in the former they produce, in a large dose, death by coma, in a smaller dose, loss of power over the voluntary muscles, sensibility being retained, with difficulty of respiration, from effusion into the lungs; in the latter, when injected in a large quantity into the veins, they cause almost instant death, producing great congestion of the lungs, and destroying the irritability of the heart; in smaller doses death is produced in the same manner as by their introduction into the stomach.

SATURDAY.

'On Opacity of the Cornea produced by Sulphuric Acid,' by R. D. Thomson, M.D.

The rapid destruction of vision, when sulphuric acid is brought into contact with the cornea, has long been known to surgeons. But the author is not aware that any accurate investigation of the cause of the opacity has been entered into. The subject came under his consideration from having attended a case along with Dr. Maddock, in which the vision of the right eye was destroyed, in consequence of a woman having thrown a quantity of oil of vitriol at a man in a fit of passion. The corrosive fluid, according to the statement of the sufferer, was only in contact with his eye about two minutes, when he had an

opportunity of washing it off with water. Yet permanent opacity of the cornea had taken place. It naturally occurred, from a consideration of this statement, that the agency of the acid could not have extended to any very considerable depth. The anatomical structure of the cornea likewise favoured this conclusion. This important part of the eye is constituted of laminæ of transparent albuminous membrane, each of which is separated by a stratum of fluid matter. These laminæ can be readily separated by the point of a knife. But in addition to these laminæ, the conjunctiva covers the whole of the anterior surface of the cornea, so that this latter membrane may be considered as the external lamina. During health the cornea is perfectly transparent: but when any cause comes into operation which prevents the free secretion and absorption of these fluids, probably from the abstraction of the aqueous portion and the greater condensation of the albumen held in solution, it happens that the cornea becomes dull and somewhat opalescent, and that peculiar appearance is produced, so familiar to the physician in the eyes of his patients. When heat is applied in the proximity of the dead cornea of the sheep, the dulness of the cornea immediately becomes apparent, a phenomenon which is to be explained by its action upon the albumen. Even without the application, however, of any external agent, the dead cornea has a glazed aspect, which is to be attributed to the action of the absorbents after death, and the consequent abstraction of the more fluid portions. When nitrate of silver, in a moistened state, is brought into close and extensive contact with the cornea, a white curdy appearance takes place, which is, in the first instance, produced by the decomposition of the common salt contained in the fluid which lubricates the eye. The secondary action is to form chemical compounds with the conjunctiva, and if the quantity of nitrate is sufficient, to extend the destructive agency to the various laminæ of the cornea. The nature of those compounds was described in a previous communication to this Section at Newcastle. When sulphuric acid or common oil of vitriol, which is a very impure substance, is brought into contact with the dead cornea of the sheep, in three or four seconds, if the experiment be watched under the microscope, the acid, which appears to swim about freely on the surface of the cornea, produces a milkiness; in half a minute, a white opacity; and in from one and a half to two minutes all translucency is destroyed. If the cornea, which has been previously extended on glass, be now plunged into water, and washed free from sulphuric acid, a permanent opacity will be found to have taken place precisely as in the case of those unfortunate individuals who have been deprived of vision by sulphuric acid in the manner already described. If we now make a section of the cornea which has been acted on by the acid, we shall find that the action has been very superficial, and that the upper and under surface of the opaque portion are parallel—and hence the influence of the acid would appear to have extended equally. If the section be now made at right angles to the axis of the eye, so as to separate the opaque from the uninjured portion, the transparency of the cornea appears to be perfectly restored, and the only defect, when a careful examination is made by the microscope, appears to proceed from the uneven surface produced by the section. But the opaque portion may likewise be readily separated, by scraping it with the point of a knife—so decided is the limit between the uninjured and opaque surfaces. It would appear from these facts, that the action of the sulphuric acid is to produce a new or false membrane, which is not removed by nature, as some other false membranes are, in consequence of its forming part of a solid body; they serve also to confirm the opinion stated by the author in a communication read at the Bristol meeting—that false membranes, as in croup, balanites, bronchitis, &c., are the consequences of the presence of an acid preternaturally secreted in the fluids of the mucous membranes where these deposits occur,—the organization of the albumen taking place under the coagulating influence of the acid. The treatment of opacity of the cornea produced by the action of sulphuric acid appears to be elucidated in no small degree by these facts;—if the acid be neutralized in the course of a few seconds, little or no injury is sustained by the cornea; but as in thirty seconds considerable opacity has occurred, and some portion of false membrane has been formed, it will be necessary to have recourse to the knife, which may be safely employed to scrape off the preternatural deposit. The author observed, that he intended to propose the operation to the patient described, so soon as the granulating action now affecting the eyelids had been subdued.

Mr. Douglass read a paper 'On Dislocations of the ankle joint backwards and forwards,' in which he detailed a case of luxation of the tibia forward, and a case of fracture, in which, previous to anatomical examination, luxation of tibia backwards was supposed to exist. The appearances previous to dissection were minutely described, as were also the relations of the different parts, as proved on examination. Casts and the prepared parts were exhibited. He also exhibited the frontal bone of a patient who in early life had been trepanned: both tables of the bone were *perfectly* renewed by new bone, contrary to what is usually observed.

A series of cases, received from Sir David Dickson, were read by the Secretary,—and also a few observations, from Mr. J. Dunn, on the Vital Statistics of Scarborough.

Section G.—MECHANICAL SCIENCE.

FRIDAY.

Mr. Wallace exhibited and explained his smoke protector.—Mr. Hawkins exhibited and gave an account of Mr. J. R. Bakewell's instrument for measuring the angles of the dip of strata.—Mr. Rayner exhibited a machine for regulating the speed of machinery in cotton-mills, &c.—Mr. Smith, of Deanston, exhibited a model of a new canal lock, the advantages of which he stated to be, that the descent in each lock would not be more than twelve to eighteen inches—that the locks were opened by the passage of the vessels—that the locks shut of themselves—that the vessels did not require to stop—and that little or no water was lost. The lock gate is hinged at the bottom, the upper portion, which is round, floats at the level of the higher part of the water, and is pressed down by the bow of the vessel in passing, and when it has passed, rises to its former position.

'Experimental Inquiry into the Strength of Iron, with respect to its Application as a Substitute for Wood in Ship-building,' by Mr. Fairbairn.

The number of vessels which of late years have been made entirely of iron, and the probability of the greatly extended use of this metal in ship-building, renders it desirable to attain additional knowledge as to its power to resist these strains to which it is subjected, in its application to the purposes above stated. Mr. Fairbairn's experiments have convinced him, that in proportion as the public become better acquainted with the valuable properties of this material, and its fitness for almost any purpose of naval architecture, they will be convinced that it is safer, and, perhaps, more durable than timber, and that confidence in it will be completely established. To meet the requirements for this purpose, the following series of experiments have been undertaken, and in a great measure completed. Part only, however, could at present be laid before the Section.—1st. A series of experiments on the strength of plates of iron, as regards a direct tensile strain, both in the direction of the fibre and across it. 2nd. On the strength of the joints in plates riveted together, and on the best modes of riveting. 3rd. On the strength of the various forms of ribs or frames used in ship-building, whether wholly composed of iron, or of iron and wood. 4th. On the resistance of plates to compression and concussion, and on the power necessary to burst them. The experiments were superintended by Mr. Hodgkinson, to whom Mr. Fairbairn acknowledged himself indebted for many of the results.

On Strength of Iron Plates.—In these experiments, all the plates were of uniform thickness. Their ends had plates riveted to them on both sides, with holes bored through them perpendicular to the plate, in order that they might be connected by both, with shackles to tear them asunder in the middle, which was made narrower than the rest for that purpose. The results were as follows:—Mean breaking weights in tons per square inch, when drawn in the direction of the fibre:—

		Tons.	
Yorkshire plates		25.77	Mean 22.52 tons.
Do.	do.	22.76	
Derbyshire	do.	21.68	
Shropshire	do.	22.83	
Staffordshire	do.	19.56	

Mean breaking weights in tons per square inch, when drawn across the fibre:—

Yorkshire plates		27.49	Mean 23.04 tons.
Do.	do.	26.04	
Derbyshire	do.	18.65	
Shropshire	do.	22.00	
Staffordshire	do.	21.01	

The foregoing experiments show that there is little difference in the strength of iron plates, whether drawn in the direction of the fibre, or across it. Mr. Fairbairn then gave the results of a long series of experiments on the strength of riveted plates. The same description of plates was here used, as in the previous experiments; the plates were, however, made wider than the former, in order that they might contain (after the rivet-holes were punched out) the same area of cross section as the previous ones. Mean breaking weights in pounds, from four plates of equal section, riveted by a single row of rivets:—

20127	Mean 18590 lb.
16107	
18982	
19147	

The mean breaking weights in pounds from four plates of equal sections to the last, but united with a double row of rivets:

22699	Mean 22258 lb.
23371	
20059	
22902	

Whence the strength of single to double riveting is, as 18590 : 22258. But from a comparison of the results taken from the whole experiments, the strength derived from the double riveted joints was, to that of the single, as 25030 : 18591, or as 1000 to 742. Comparing the strength of plates alone with that of double and single riveted joints, Mr. Fairbairn gave their relative values as under:—

For the strength of the plate	100
For that of double riveted joints	70
And for the single riveted joints	56

Hence, the strength of plates to that of the joints, as the respective numbers, 100, 70, and 56. Mr. Fairbairn then gave a table containing the dimensions and distances of rivets for joining together different thicknesses of plates.

A discussion ensued as to the comparative strength and safety of iron boats. Mr. Fairbairn stated, that from the manner in which the sheathing is riveted, the whole vessel becomes one mass; and though he did not come forward as the advocate of iron against wood, he would state that he considered iron as one-third stronger than wood, weight for weight.—Mr. Grantham knew iron boats that had lasted twenty-eight years in fresh water.—Mr. Taylor built an iron boat for a canal in 1805, and it was now in good condition.—Mr. Mallet had found from his experiments on the action of sea water upon iron, that the duration of a half-inch plate in sea water would be about 100 years.

Mr. Hodgkinson read a paper 'On the Strength of Pillars of Iron.' This was an abstract of a paper by Mr. Hodgkinson, read at the Royal Society, of which we gave an abstract at the time.—(See *Athenæum*, No. 659.)

Mr. Fairbairn 'On Raising Water from Low Lands.'—The Commissioners for draining the Lake of Haarlem having applied to Mr. Fairbairn on the subject, he proposed a method where the water is raised by a large scoop, which rises on the descent of a weight, which weight is raised by steam power, on the Cornish principle. It is calculated to raise seventeen tons at each stroke. Mr. Fairbairn exhibited a model in illustration.

Mr. Taylor mentioned, that he had that morning received a letter from Mr. Enys, stating that Commissioners from the Dutch government had visited Cornwall, to ascertain the duty done by the Cornish engines. Several experiments had been made at their request, and the following was the result.

		Feet stroke.	Lifted one foot.
Wheal Vor, Borlase's engine	80 in. single	8.0	123,300,593lb.
Fowey Consols, Austin's	80 ..	9.0	122,731,766
Wheal Darlington engine	80 ..	8.0	78,257,675
Charlestown United Mines	50 ..	7.5	55,912,392
Ditto Stamping engine	32	lifting 66 stamps	60,525,000
Wheal Vor, ditto ..	36 dble.	lifting 72 stamps	50,085,000

Mr. Glynn stated, that by a scoop wheel 25 feet diameter, and 80 horse power, used by him in Lincolnshire, 4½ tons of water were raised in a second, the difference of level being about five feet.

Mr. Hodgkinson exhibited Mr. Clegg's New Safety Lamp.—It does not differ in principle from Davy's lamp, but is surrounded by a triangular frame with bull's-eye glasses.

Rev. J. Brodie gave an account of a uniform propelling wheel for steam-boats, and directed attention to the proper form of the leaves of a propeller on the Archimedean principle. It was also capable of being used as a ventilator, if driven by machinery.

Mr. Dunn 'On an Improved Working Barrel Pump in sinking Pits.'—Mr. Dunn stated, that his improvement consists in attaching a branch side pipe, of about one-third the diameter of the working barrel, extending from above to below the space traversed by the bucket, in which pipe is inserted a cock, whereby to regulate the discharge of water from the column above into the space below;—to prevent air being drawn into the pumps, whereby the equilibrium of the engine is destroyed and much damage done. The lock can readily be manœuvred by the sinkers at the bottom of the pit, by means of an iron rod.

Dr. Farquharson 'On Sea-borne Vessels.'—Dr. Farquharson suggested an alteration in the form of steam-ships, which he proposes should be constructed somewhat in the form which biblical critics have given to the Ark of Noah.

Mr. Evans delivered in a printed report, 'On Anthracite Pig-iron.'

OUR WEEKLY GOSSIP.

By way of supplement to our notice of the Birmingham Festival, we may mention that the receipts of that meeting were greater than on any previous occasion,—the expenses a trifle less. The Londoners have enjoyed, to speak fancifully, an appendix to one of its finest chapters, in the organ-playing of Dr. Mendelssohn, during the past week. We have heard nothing on the instrument comparable to his performance on Tuesday at Christ Church, Newgate Street. Among other notable things he played a *passacaglia* and fugue by Sebastian Bach, a *pastorale* and fugue, we believe of his own composition, besides sundry displays of extempore power; in the last combining the themes of the first and last choruses of Handel's 'Israel' with an ease, science, variety, and brilliancy not to be forgotten. To extemporize upon the organ, where, in addition to the hands, the feet have also a prominent and separate part to play, is no holiday undertaking, as our musical readers know—nor one to be disposed of by exhibiting a few showy tricks, or stringing together a few remembered passages. There must be coherence of thought, as well as power of foot and finger,—a thorough acquaintance with the strict and free styles of music; and a knowledge of the general capabilities of the instrument, which, however, are wrought out in every variety of detail; hardly any two organs being alike, in weight of touch, range of pedal-board, composition of stops, &c. The Christ Church organ, by the way, is so fine a one, as to demand especial notice. It is now, if we mistake not, the largest in London, having been recently enlarged and decorated by sundry benefactors, whose names, in a good old English fashion, are blazoned on different parts of its case. The brilliancy of the full organ is greater than that at Birmingham, which, indeed, struck us as somewhat ponderous in tone: the keys, too, we believe, answer the fingers far more easily. Like misfortunes, organs do not come alone: the Liverpool people are threatening to build a monster for their Town Hall, larger than the Boanerges of Birmingham; and not far from Christ Church, an instrument has been placed in St. Peter's, Cornhill, of which very good things are told us.

It is with pleasure that we notice preparatory steps on the part of the Society of British Musicians to commence their Concerts again; inasmuch that we cannot but believe that during their pause, they must have become alive to the causes of their former want of success: with "improved principles" (as the puffs express it) they have our best wishes. It is said that Mr. Eliason has arranged with Herr Schumann for a series of German operas, to be given at Drury Lane Theatre in March next. The new ballet at the *Académie Royale*, 'Le Diable Amoureux,' seems to have been completely successful—splendid in its decorations—surprising in its scenic changes—and affecting in its pantomime, as performed by our old London acquaintance, Mdlle. Pauline Leroux.

Letters from Teffiis, received in St. Petersburg, give further accounts of the convulsion on Mount Ararat; by which it appears, that the consequences have been far more fearful than the first announcements had given reason to apprehend. The town of Nakitchevan has been totally destroyed—all the buildings of Erivan more or less injured—and the whole of the villages in the two districts of Scharour and Sourmata have perished. The cotton and rice plantations are all laid waste; but the immediate neighbourhood of the mountain itself has been the scene of the most awful calamity. A huge mass slid from the mountain, overwhelming every thing and person in its progress, for a distance of seven wersts (about five English miles). Amongst others, the great village of Akhouli has had the fate of Herculaneum and Pompeii, and above 1,000 inhabitants have been buried beneath the fallen rocks. The mountain opened, giving passage to a thick fluid, which swelled into a river, and, following the same direction, swept over the ruins. At the date of the 13th August, Ararat was not yet quiet.

The sale, at Ghent, of M. Schamp d'Aveschoot's pictures, was well attended, and the pictures fetched good prices. The 'Toilet,' by Gabriel Metzu, sold for 5,100 francs, and a full-length portrait of Rembrandt, painted by himself, for 15,190 francs. A portrait of Mieris, by himself, for 2,300 francs; the 'Fat Cook,' by Jan Steen, for 3,050 francs; an Interior, by Ostade, for 6,700 francs; and the gem of the collection, 'The Miracle of St. Benedict,' a sketch, by Rubens, for 25,700 francs. A 'View in Flanders,' by Teniers, was bought by the Belgian Minister of Public Works for 14,600 francs.

The Royal Academy of Fine Arts in Paris has elected M. Caristie to the chair vacated in the Architectural Section by the death of M. Huyot.—The Academy of Inscriptions and Belles Lettres was occupied, at its sitting on the 25th of the last month, in the distribution of its various prizes,—the most important of which was the great historical one founded by the Baron Gobert, and adjudged to M. Ampère, for his 'Histoire Littéraire de la France avant le douzième siècle'—the smaller prize being given to M. Amans-Alexis Monteil, for his 'Histoire des Français des divers États aux cinq derniers siècles.'

A French paper, the *Amoricain de Brest*, gives an interesting account of four Laptots of Senegal, who are exciting the public curiosity in that town, as they traverse its streets in their long white *burnoies*. These Laptots are free negroes—fishermen or sailors—from Guet n' dar, a village facing Saint Louis du Sénégal, on the opposite bank of the river. They are in the service of government; and their skill and knowledge of the coast renders their aid indispensable to that navigation. Two of them are Marabouts—know the Koran by heart, in Arabic—without, however, understanding a word of it; and are scrupulous observers of the prescriptions of their religion, drinking only water, and touching no meat prohibited by Mohammed. They were near dying of hunger on board the vessel which brought them over—no other provisions remaining but fat pork. The two others are less precise, and have no objection whatever to get drunk. They are all passionately fond of dancing. They had, it appears, a great terror of coming to France, where they were apprehensive of perishing with cold. Their residence there is now marvellously to their taste; and they have become accustomed to houses of several stories, into which, at first, they dared not enter. Above all they are proud of being served by white men, (the hospital-convicts) they, as blacks, having hitherto regarded themselves as the perpetual servitors of the white races.

Letters from Berlin mention that the prohibition imposed by Frederick the Great on the publication of any of his musical works, (amid his eagerness to see all his literary productions in print) after having been respected during his life, and up to the present period, has been at length broken. M. Sigismond Delin has published the score of an Italian opera in one act, by the monarch, entitled 'Il Re Pastore,' performed for the first time on the 3rd of August, 1747, in the orangery of the Palace of Charlottenburg before the royal family. This musical curiosity is accompanied by a *fac-simile* of the manuscript; and the work itself is spoken of as "distinguished by agreeable melodies, and an instrumentation that displays a profound contrapuntist." It is said to be "remarkable for the extreme care which the royal composer took to give brilliancy to the airs belonging to the part of Nice," designed by him for one of the most celebrated Italian singers of the time, Madame Astrua—who did, in fact, make her first appearance in Berlin on the occasion of the first representation of the opera.

MUSIC AND THE DRAMA

Haymarket.—Under the quaint title of 'Master Clarke,' a clever and not uninteresting play, has been written by Mr. Serle, apparently with the view of rescuing from the limbo of oblivion the visionary career of that shadow of the genius of Cromwell, his son Richard, who assumed the name of Clarke, the better to preserve the *incognito* he sought in the privacy of a country life. One so passive and feeble in nature as Richard Cromwell, though blameless and well-intentioned in his actions and motives, is hardly a fit subject for an historical drama, which requires to deal with more substantial qualities, either bad or good. Neither do we think him an exemplar of the negative virtue of "forbearance," in which light the author intends to set forth his character. The merit of forbearance implies the power of resistance, which cannot be said to belong to Richard Cromwell. It is true, that he forbore to shed blood and foment plots, because he felt that both would but help him to hold a little longer a power which he could not wield, and which must eventually be wrenched from him. The author's affection for his hero, however, clothes his delineation with a human interest sufficient, with the powerful aid of Macready's acting, to occupy the attention. In order to sustain through five acts the historical action that ends with Richard Cromwell's abdication in the second, he is represented as personally submitting to Charles, from whom he obtains a safe conduct under the cognomen of "Master Clarke, the King's friend;" and as being mixed up, through the vanity and ambition of his wife, with a conspiracy of *Desborough* and other leaders of the army to seize the king's person, which ends in *Master Clarke* arresting the traitors with the force he was expected to bring to their assistance. The play is constructed upon the melo-dramatic principle of stimulating the senses of the audience by extrinsic excitement, such as distant shouts, hurried footsteps, loud knocking, and other denotements of imminent peril; but these sounds of the storm raging without, only make the situation of the hero seem more secure, as we feel more snug by the fireside when the wind roars and the rain beats. There is some good writing in the course of the dialogue, which, however, is distinguished more by good sense and kindly feeling than dramatic force or poetical beauty; and the strokes of satire, mostly of temporary application, pleased the audience, who were not fastidious enough to object to the execrable and homely jokes that are lugged in by the head and shoulders to enliven the comic portion of the play. Mr. Macready's personation we have before alluded to, and need only say farther, that he gives to *Master Clarke* an appear-

ance of worth, manliness, and unassuming dignity that engages sympathy, if it does not excite admiration; the subdued force of his acting is such that it is felt by its effect on the audience, rather than perceived in the efforts of the performance. Miss Faucit's exaggerated style of playing *Lady Cromwell* is the more remarkable from the contrast; her agitation looks like ill-temper, and her fondness has an air of cant. Mr. J. Webster libels *Charles the Second*, who, with all his faults, was a gentleman in his deportment, and Mr. Phelps represents *Desborough* as a mere bravo. The scenery and costumes are creditable to the management, though *Secretary Thurloe* surely should not be tricked out in the court suit of a cavalier.—Mr. Maywood, a veteran comedian from America, has essayed the arduous character of *Sir Pertinax Macsycophant* in 'The Man of the World' this week, and was favourably received, notwithstanding his performance consisted merely of a bad imitation of the Scotch dialect and excessive gesticulation, and was at once coarse and weak.

Covent Garden.—'The Bride of Messina' is played nightly, and draws good houses. 'The Greek Boy,' a light and pleasant musical entertainment, by Mr. Lover, makes a pretty afterpiece, combining the singing of Vestris as the *Greek Boy*, the humorous acting of Keeley, a lively dance or two, and some beautiful views in Venice, in which the Rialto, Sta. Salute, and St. Mark's Place, are brought before the eye with all the power of scenic art.

Surrey.—We made a pilgrimage to this *ultima Thule* of the theatrical world, purposely to see how Mr. Kenney had treated the subject of John of Procida, and a little curious to ascertain the merits of a tragedy written by a popular farce-writer, which had been shelved in two theatres royal; but it was impossible to feel any interest in the characters, and so difficult to see anything in the plot beyond a device for the exits and entrances of several persons of both sexes, who ranted most horribly, and for a "grand massacre" and blow-up at the end, that we had rather not offer any opinion on the merits of the drama—especially as some phrases caught our ear that were more high-sounding than intelligible, and as the audience seemed to feel as little interest in the performance, and to understand it no better than ourselves. We incline to the opinion, that in this instance Mr. Kenney is out of his element; for Mr. Elton, who played the hero, is able to do justice to good dialogue; so that all the fault does not rest with the performers, ludicrously bad as most of them are. The house was completely filled by a decent, attentive, and well-behaved audience.

Princess's.—This is the appellation bestowed, by royal permission, before the "Princess" Victoria became Queen, on the new theatre in Oxford Street, of which we gave a description a few weeks back. It was opened on Wednesday, with the *pis aller* of playhouses without actors, Promenade Concerts, for the purpose of filling up the interval before the commencement of the Opera season, and turning to account the public curiosity to gaze at the sumptuous embellishments of one of the handsomest little theatres in Europe. The coup-d'œil is rich, without gaudiness; and the effect of the superb decorations by the light of a chandelier of fanciful design, is brilliant in the extreme. Though there is not a handbreadth devoid of some kind of ornament,—arabesques where all hues are blended being intermingled with figures and devices in relief gilded and painted—and the boxes are bordered with cushions and vallances of crimson velvet, and curtains of damask of the same hue, yet there is neither glare nor excess—the style of La Renaissance, admitting of as large a quantity and variety of decoration as can be combined. The skill of the designer is shown in the subserviency of the ornaments to the architectural forms, and the harmonious and massive effect of the *ensemble*, which neither distracts nor fatigue the eye.—A rumour is current, that the Promenade Concerts will, ere long, give place to an operatic company, under the auspices of Mr. John Barnett.

To Correspondents.—J. G. B.—H. O. N.—A. B.—E. O. P.—An old Subscriber received.—We thank R. H., but decline.

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